

**IMPLEMENTING CLIMATE CHANGE
ADAPTATION PLANNING IN ACCORDANCE WITH
EXECUTIVE
ORDER 13514
“Federal Leadership in Environmental, Energy, and Economic
Performance”**

FEDERAL AGENCY CLIMATE CHANGE ADAPTATION PLANNING

Support Document

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EXECUTIVE SUMMARY

The Council on Environmental Quality has issued *Implementing Instructions* to be used by the Federal Government in climate change adaptation planning. The document, *Federal Agency Climate Change Adaptation Planning: Implementing Instructions, (Implementing Instruction)*, establishes requirements for climate change adaptation planning for the next year, as recommended by the Interagency Climate Change Adaptation Task Force¹ and authorized by Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. This Support Document provides information to assist Federal agencies with meeting the *Implementing Instruction* requirements.

Federal adaptation planning is necessary to address the effects of climate change that affect Federal services, operations, programs, assets (e.g., infrastructure, land and water resources), and national security. By integrating climate change adaptation strategies into its planning, the Federal Government can ensure that resources are invested wisely and that Federal agencies remain effective in current and future climate conditions.

The *Implementing Instructions* require agencies to establish an adaptation policy that commits the agency to climate change adaptation planning, complete a high-level analysis of potentially significant climate change impacts to its mission and operations, and prepare an agency climate change adaptation plan by June 2012. The instructions identify several interim steps for the high-level analysis and plan development. In addition, agencies must identify a point of contact for carrying out the climate change adaptation planning actions and coordinate with other agency adaptation planning and interagency efforts to develop national adaptation plans where appropriate.

The following table summarizes the requirements in the *Implementing Instructions*.

¹ *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*, October 5, 2010.

Summary of 2011 *Implementing Instructions* for Climate Change Adaptation Planning

1. ***Establish an agency climate change adaptation policy and mandate***
 - By April 15, 2011, each agency shall identify an agency climate change adaptation planning point of contact for the *Implementing Instructions*.
 - By June 3, 2011, each agency shall issue an agency-wide policy statement signed by the head of the agency that commits the agency to climate change adaptation planning.
2. ***Increase understanding of how the climate is changing***
 - During 2011, each agency shall participate in Council on Environmental Quality sponsored climate change adaptation planning workshops to increase agency understanding of how the climate is changing and share information within the agency about how climate change impacts the agency.
3. ***Apply understanding to agency mission and operations***
 - By June 3, 2011, each agency shall submit responses to guiding questions found in Appendix E.
 - By September 30, 2011, each agency shall submit a draft high-level analysis of agency vulnerability to climate change.
 - By March 2012, each agency shall complete a final high-level analysis of agency vulnerability to climate change.
4. ***Develop, prioritize, and implement actions***
 - By September 30, 2011, each agency shall identify three to five priority adaptation actions to be implemented in FY 2012.
 - By June 4, 2012, each agency shall submit an agency climate change adaptation plan and make it available for public comment.
5. ***Evaluate and Learn***
 - During 2011, each agency shall participate in Council on Environmental Quality sponsored climate change adaptation planning workshops and share lessons learned with other agencies.

I. **INTRODUCTION**

Section 8(i) of Executive Order 13514 *Federal Leadership in Environmental, Energy, and Economic Performance* (Executive Order), specifies that each agency shall “evaluate agency climate change risks and vulnerabilities to manage the effects of climate change on the agency’s operations and mission in both the short and long term.”

Section 16 of the Executive Order charges agencies to actively participate in the Interagency Climate Change Adaptation Task Force (Task Force) and mandates the Task Force to develop recommendations for the President on how the policies and practices of Federal agencies can be made compatible with and reinforce a national climate change adaptation strategy.

The Task Force, composed of over 20 Federal agencies and Executive branch offices and co-chaired by the Council on Environmental Quality, Office of Science and Technology Policy, and the National Oceanic and Atmospheric Administration, submitted its *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy* to the President on October 5, 2010.² The Task Force found that:

The Federal Government also has an important stake in adaptation because climate change directly affects a wide range of Federal services, operations, programs, assets (e.g., infrastructure, land), and our national security. The Government must exercise a leadership role to address climate impacts on Federal infrastructure interests and on natural, cultural, and historic resources that it has statutory responsibilities to protect. The Federal Government should identify its most significant adaptation risks and opportunities and incorporate response strategies into its planning to ensure that Federal resources are invested wisely and that its services and operations remain effective in the context of a changing climate.³

Specifically, the Task Force recommended that Federal agencies establish and implement coordinated climate change adaptation plans that address the challenges posed by climate change to their missions,

² See Appendix A for a summary of the recommended actions the Task Force included in its 2010 Progress Report to the President. The full report can be downloaded at <http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation>.

³ *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*, October 5, 2010. pg. 8.

programs, and operations. Adaptation plans will help agencies adapt or adjust to climate change to reduce the negative effects and take advantage of new opportunities that climate change may bring.

The Task Force recommended that the Chair of the Council on Environmental Quality issue *Implementing Instructions* on adaptation planning to agencies within 120 days of the release of its *Progress Report*. To respond to this recommendation, the Council on Environmental Quality worked with the Interagency Climate Change Adaptation Agency Working Group⁴ (Agency Working Group) to prepare *Implementing Instructions* for agencies to initiate climate change adaptation planning. This document provides background information to support the *Implementing Instructions*.

A. PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide information to assist agencies in meeting the requirements of the *Implementing Instructions* and in effectively achieving the long-term goal of integrating climate change adaptation into agency programs, policies, and operations. The Council on Environmental Quality and the Agency Working Group will provide additional information, training, and guidance to supplement the *Implementing Instructions* and this Support Document, as needed.

B. AUTHORITY FOR IMPLEMENTING INSTRUCTIONS

The *Implementing Instructions* are issued under the authority of Section 5(b) of Executive Order 13514, which authorizes the Chair of the Council on Environmental Quality to issue instructions to implement the Executive Order.

C. OVERSIGHT AND ORGANIZATION OF FEDERAL AGENCY ADAPTATION PLANNING

The Council on Environmental Quality works closely with the Office of Management and Budget to oversee Federal agency implementation of Executive Order 13514. In addition, the Council on Environmental Quality chartered the Task Force's Agency Working Group to support development of the *Implementing Instructions* on adaptation planning.

Under the *Implementing Instructions*, Federal agencies will submit required information on climate change adaptation planning directly to the Chair of the Council on Environmental Quality. Federal

⁴ See Appendix B for a list of agencies that participate in the Interagency Climate Change Adaptation Agency Working Group.

agencies will submit adaptation planning materials as part of, or as attachments to, their Federal agency Strategic Sustainability Performance Plan required under section 8 of Executive Order 13514. Agencies have flexibility on how to organize their own adaptation planning processes; this is discussed further in Sections III.D and III.E of this document.

II. VISION AND POLICY DIRECTIVE

The guiding vision for the Federal Government's work on climate change adaptation is a resilient, healthy, and prosperous Nation in the face of a changing climate. Realizing this vision will require planning and meaningful changes to policies, behavior, and institutions. It will also require a commitment to respond to existing climate change while simultaneously taking steps to understand and prepare for future climate conditions.

The goal of Federal agency adaptation planning is to ensure that Federal agencies continue to achieve their missions and program goals and to operate in a secure, effective, and efficient manner in a changing climate. The overarching policy directive for Federal agencies is to implement climate change adaptation planning, applying the guiding principles and the adaptation planning framework found in Sections III.C. and III.D of this document.

Federal agencies must take action to understand, prepare for, and respond to how climate change may impact their mission, programs, and operations. Integrating climate change information into strategic planning will help reduce potential consequences to mission and high costs associated with delayed response to climate change impacts. Adaptation planning will also enable agencies to identify opportunities to improve performance and efficiency.

Climate change adaptation planning is an iterative process; our understanding of different types of adaptive actions will evolve as the climate system changes and as our climate knowledge and understanding deepens. Climate change adaptation should be integrated into each agency's programs and operations so that it becomes standard practice. However, this phased approach to implementation does not mean that agencies should delay taking advantage of immediate opportunities. Targeted near-term adaptive actions can move forward as broader, long-term planning efforts are undertaken.

III. ADAPTATION PLANNING BACKGROUND

A. THE CLIMATE IS CHANGING

There is broad scientific consensus that the Earth's climate is changing due to increased emissions of heat-trapping greenhouse gases as well as black carbon particles.^{5,6,7} Already, average air and water temperatures are rising at the Earth's surface (Figure 1) and this is expected to continue to varying degrees depending on future emissions (Figure 2).⁸

In order to reduce the impacts of climate change, it is necessary to both reduce (mitigate) emissions of heat-trapping pollution and build resilience (adapt) to the impacts of climate change. However, even with strong programs to reduce greenhouse gas emissions, the effects of climate change will persist due to the longevity of certain greenhouse gases in the atmosphere and the absorption of heat by the Earth's oceans. Adaptation planning is required to

address the consequences of climate change impacts that are already occurring. Therefore, mitigation and adaptation are inextricably linked.

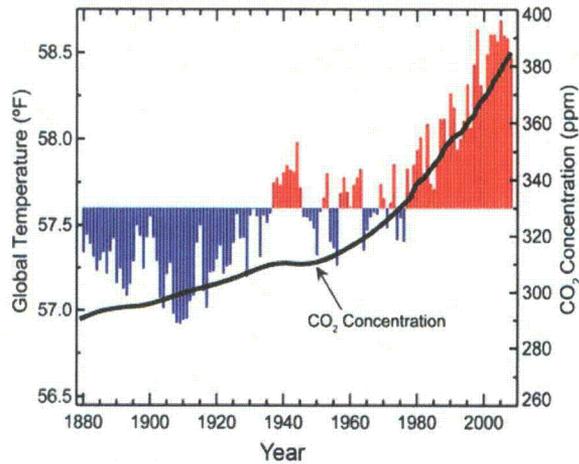


Figure 1. Global annual average temperature (as measured over both land and oceans) and carbon dioxide concentration from 1880 to present day. Red bars indicate temperatures above and blue bars indicate temperatures below the average temperature for the period 1901-2000. Year-to-year fluctuations in temperature are due to natural processes, such as the effects of El Niños, La Niñas, and the eruption of large volcanoes.¹

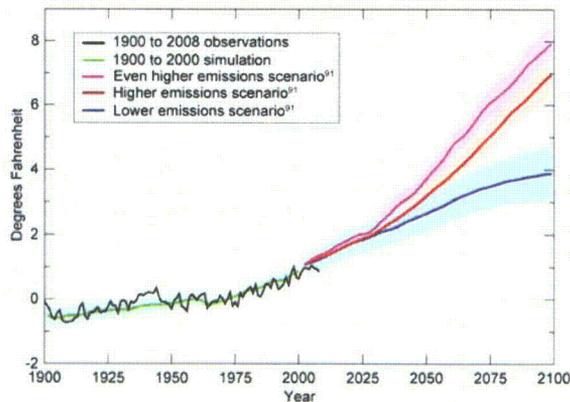


Figure 2. Observed and projected changes in the global average temperature under three IPCC emissions scenarios. The lines show the central projections from a set of climate models, and the shaded areas indicate the likely ranges of these projections. A wider range of model types shows outcomes from 2 to 11.5°F. Changes are relative to the 1960-1979 average.²

¹ *Global Climate Change Impacts in the United States*, Karl, Thomas R., Melillo, Jerry M., Peterson, Thomas C., (2009).

² *Ibid.*

⁸ *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Parry, M.L., Canziani, O. F., Palutikof, J. P., van der Linden, P. J., et. al., contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 2007 (2007).

⁶ *Global Climate Change Impacts in the United States*, Karl, Thomas R., Melillo, Jerry M., Peterson, Thomas C., (2009).

⁷ *Advancing the Science of Climate Change*, America's Climate Choices: Panel on Advancing the Science of Climate Change, National Research Council, (2010).

⁸ *Global Climate Change Impacts in the United States*, Karl, Thomas R., Melillo, Jerry M., Peterson, Thomas C., (2009).

The 2009 U.S. Global Change Research Program (USGCRP) report, *Global Climate Change Impacts in the United States*, documents climate change impacts to the Nation that already have been observed. These impacts include increased average temperatures, more frequent heat waves and high-intensity precipitation events, sea level rise, more prolonged droughts, and more acidic ocean waters, among others.⁹ The year-round average air temperature of the continental United States has already risen by more than 2°F over the past 50 years and is projected to further increase in the future.¹⁰ In addition, the intensity of very heavy precipitation events has increased across the United States over the last 50 years (Figure 3), and continued increases in both frequency and intensity of the heaviest downpours are projected in the future. At the same time, the number of dry days is projected to increase, especially in the more arid areas. The Midwest and the Southwest are particularly threatened by future drought.¹¹

Climate change impacts, both within the United States and across the globe, are not distributed evenly. For example, global, temperature increases since the middle of the 20th century have generally been greatest at the high, northern latitudes (Figure 4). Temperatures in Alaska have increased by approximately twice as much as in the rest of the Nation, with significant

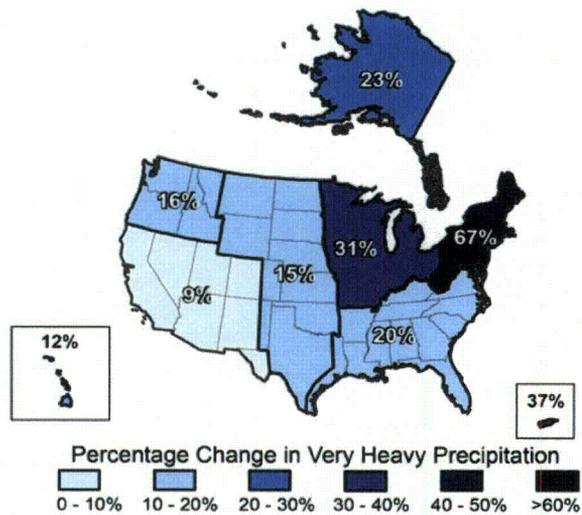


Figure 3. Percent increases in the amount falling in very heavy precipitation events (defined as the heaviest 1% of all daily events) from 1958 to 2007 for each region.¹

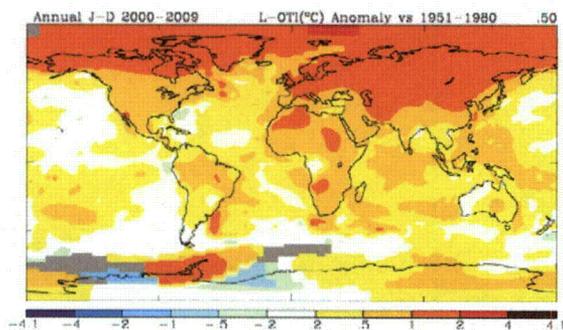


Figure 4. Average surface temperature trends (degrees per decade) for the decade 2000-2009 relative to the 1950-1979 average. Warming was more pronounced at high latitudes, especially in the Northern Hemisphere and over land.²

¹ *Global Climate Change Impacts in the United States*, Karl, Thomas R., Melillo, Jerry M., Peterson, Thomas C., (2009).

² *Advancing the Science of Climate Change, America's Climate Choices: Panel on Advancing the Science of Climate Change*, National Research Council, (2010).

⁹ *Ibid*

¹⁰ *Ibid.*

¹¹ *Ibid.*

impacts to sea ice, ecosystems, and coastal communities.¹² The uneven nature of climate change impacts contributes to differing levels of vulnerability¹³ across countries, and communities, with important implications for adaptive actions. Many non-climatic stressors can interact with and exacerbate the impacts of climate change. Social and economic factors (e.g., economic status, race, ethnicity, age, gender, and health) can significantly affect people's exposure and sensitivity to climate change, as well as their ability to respond and adapt. Certain ecosystems (e.g., coral reefs, wetlands, Arctic habitats) are particularly vulnerable to the impacts of climate change. In addition, ecosystems that are degraded or depleted due to stressors that may not be directly influenced by climate (e.g., habitat destruction, over-harvesting, pollution) have lower resilience¹⁴ to climate change effects. Impacts of climate change on ecosystem services – the benefits ecosystems provide that humans depend on, such as clean water, coastal protection, flood protection, food production, and recreation – are a major concern. Examples of climate change impacts by sector can be found in Appendix F.

B. WHAT DOES IT MEAN TO PLAN FOR AND ADAPT TO CLIMATE CHANGE AND WHY IS IT IMPORTANT FOR AGENCIES?

Climate change adaptation means adjusting to a changing climate to reduce the negative impacts already occurring and taking advantage of new opportunities. In general, planning in advance for climate change impacts will help avoid disruptions to Federal agency operations and allow the Government to design and implement programs that are capable of achieving their missions across a range of future climate conditions.

Federal agencies have an important stake in adaptation because climate change directly affects Federal services, operations, and programs across the country.

Historically, Federal agencies have adjusted or adapted to natural variability in climatic conditions. However, the pace and impacts of climate change are occurring

outside the range of past experiences, and this may make past practice insufficient. Federal agencies with

“Adaptation requires careful planning to incorporate appropriate strategies in agency missions and operations to ensure that Federal resources are invested wisely and that agency services and operations remain effective.”

-- *Interagency Climate Change Adaptation Task Force, October 2010*

¹² *Ibid.*

¹³ Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. From *Adapting to the Impacts of Climate Change, America's Climate Choices: Panel on Adapting to the Impacts of Climate Change* National Research Council (2010).

¹⁴ Resilience is a capability to anticipate, prepare for, respond to, and recover from significant multihazard threats with minimum damage to social well-being, the economy, and the environment. From *Adapting to the Impacts of Climate Change, America's Climate Choices: Panel on Adapting to the Impacts of Climate Change* National Research Council (2010).

staff that perform the majority of their duties out of doors, such as the military, may require additional resilience to extreme heat, extreme cold, or more frequent and severe storm events. Increased frequency of flooding can lead to inundation and loss of archeological sites, historic landscapes, architecture, and traditional resources; a variety of responses will likely be needed to address impacts to these and other cultural resources. Public lands may need to be managed to take into account an increase in droughts and wildfires. If proper advance planning measures to account for future effects of climate change are taken, the cost to Federal agencies should be significantly less than if agencies were to take a reactive approach.

Certain Federal agencies have already started the process of assessing the impacts of a changing climate on mission and operations. The Department of Homeland Security's (DHS) February 2010 Quadrennial Homeland Security Report identified global climate change as a long-term trend and global challenge that threatens America's national security interests. DHS's June 2010 Strategic Sustainability Performance Plan also includes a commitment to develop a climate change adaptation plan at the Department and Component level for its facilities and concluded that "climate change could have significant mission and cost impacts for DHS."¹⁵

In addition, the Department of the Interior (DOI) adopted a High-Priority Performance Goal in 2010 requiring the Department to "identify the areas and species ranges in the U.S. that are most vulnerable to climate change, and begin implementing comprehensive climate change adaptation strategies in these areas." DOI's Climate Change Response Council, chaired by the Secretary and composed of senior leaders throughout the Department's bureaus and offices, is leading this initiative. Additional examples of ongoing Federal agency adaptation measures are provided in the box below and in Appendix H.

While the *Implementing Instructions* and Support Document focus on Federal agency adaptation planning, coordinating with local, state, Tribal, and other organizations will be important as agencies move forward with adaptation planning. Many of these organizations are already leaders in adaptation, and the Federal Government can learn from these efforts and should coordinate with them as appropriate. Appendix I provides examples of state and local government adaptation planning.

¹⁵ See Appendix H for a case study of DHS's agency-wide climate change adaptation planning efforts.

Examples of Federal Adaptation to Climate Change

- The National Oceanic and Atmospheric Administration (NOAA) is developing **programmatic guidance to consider climate change impacts in coastal habitat restoration, land acquisition, and facility development investments**. The guidance will help NOAA ensure it is investing its resources wisely as the climate changes. For example, if restoration projects are not designed to accommodate sea level rise, large scale wetland restoration effort may become submerged by rising sea levels and unable to provide the long-term ecosystem and economic benefits desired.
- The Department of Transportation has analyzed the **vulnerability of transportation infrastructure** in the Gulf of Mexico Region and is further analyzing critical infrastructure in Mobile, Alabama. DOT is also developing risk management tools to minimize climate change impacts to transportation infrastructure that can be applied in the Gulf and elsewhere.
- The U.S. Army Corps of Engineers and the DOI's Bureau of Reclamation are working together to understand climate change impacts to water resources management, identify knowledge gaps to inform research priorities, and develop consistent guidance for use in water resources management planning and operations. For example, they recently published a joint report that identifies the needs of local, state, and Federal water management agencies for climate change information and tools to support long-term planning.
- The Department of the Navy (the Navy) established Task Force Climate Change, which has developed and is now implementing two roadmaps for climate change adaptation in the Arctic and across the globe. Activities include conducting joint and combined exercises in the Arctic, **educating staff on climate change science and security**, and **incorporating adaptation into the Navy's strategic objectives**.
- The U.S. Agency for International Development has prepared a guidance document on **integrating adaptation into foreign assistance programs** and sponsored the development of the Famine Early Warning Systems Network.

C. GUIDING PRINCIPLES FOR ADAPTATION PLANNING

The Task Force identified a set of guiding principles that governments, communities, the private sector, and others should consider when designing and implementing adaptation strategies. The *Implementing Instructions* require that Federal agencies adopt the guiding principles in their climate change adaptation policy required under section I(A)(2) of the *Implementing Instructions*.

Guiding Principles for Climate Change Adaptation

Adopt integrated approaches. Climate change adaptation strategies should be integrated into core policies, planning, practices, and programs.

Prioritize the most vulnerable. Adaptation plans should prioritize helping people, places, and infrastructure that are most vulnerable to climate impacts. They should also be designed and implemented with meaningful involvement from all parts of society. Issues of inequality and environmental justice associated with climate change impacts and adaptation should be addressed.

Use best-available science. Adaptation should be grounded in best-available scientific understanding of climate change risks, impacts, and vulnerabilities. Adaptive actions should not be delayed to wait for a complete understanding of climate change impacts, as there will always be some uncertainty. Plans and actions should be adjusted as our understanding of climate impacts increases.

Build strong partnerships. Adaptation requires coordination across multiple sectors, geographical scales, and levels of government and should build on the existing efforts and knowledge of a wide range of stakeholders. Because impacts, vulnerability, and needs vary by region and locale, adaptation will be most effective when driven by local or regional risks and needs.

Apply risk-management methods and tools. A risk management approach can be an effective way to assess and respond to climate change because the timing, likelihood, and nature of specific climate risks are difficult to predict. Risk management approaches are already used in many critical decisions today (e.g., for fire, flood, disease outbreaks), and can aid in understanding the potential consequences of inaction as well as options for risk reduction.

Apply ecosystem-based approaches. Ecosystems provide valuable services that help to build resilience and reduce the vulnerability of people and their livelihoods to climate change impacts. Integrating the protection of biodiversity and ecosystem services into adaptation strategies will increase resilience of human and natural systems to climate and non-climate risks, providing benefits to society and the environment.

Maximize mutual benefits. Adaptation should, where possible, use strategies that complement or directly support other related climate or environmental initiatives, such as efforts to improve disaster preparedness, promote sustainable resource management, and reduce greenhouse gas emissions including the development of cost-effective technologies.

Continuously evaluate performance. Adaptation plans should include measurable goals and performance metrics to continuously assess whether adaptive actions are achieving desired outcomes. In some cases, the measurements will be qualitative until more information is gathered to evaluate outcomes quantitatively. Flexibility is critical to building a robust and resilient process that can accommodate uncertainty and change.

D. FEDERAL FRAMEWORK FOR CLIMATE CHANGE ADAPTATION PLANNING

1. Overview

Under the *Implementing Instructions*, Federal agency adaptation planning should be based on the flexible planning framework depicted in the figure below. The flexible planning framework is not meant to be prescriptive or to provide detailed recommendations for project-level adaptation; those detailed options will be developed over time by each agency with the help of a growing set of planning tools, illustrative case studies, and lessons learned. Instead, the flexible planning framework will help Federal agencies identify climate change impacts of greatest concern, set priorities, implement adaptive measures, and evaluate, share, and learn from those actions.

The core elements of the flexible planning framework are as follows:

Establish a mandate and policy. Effective adaptation planning and implementation requires a mandate or policy statement with clear objectives and metrics. This step of the planning framework asks, “What are our goals?” and “What is success?” These questions should be answered in the context of each agency’s mission and operations. In 2011, agencies will identify a senior agency official responsible for carrying out the climate change adaptation planning actions required by the *Implementing Instructions* and issue a policy statement that commits the agency to climate change adaptation planning. See Section IV.A for further discussion.

Understand how the climate is changing. At this stage, agencies should ensure that they have an understanding of the best-available, actionable climate change science with the goal of understanding how their agency will respond to the following questions: “What aspects of the climate are changing, at what rates, and over what spatial scale (i.e., at the global, national, regional, and local level)? What uncertainties are associated with the projected impacts of climate change? How do these compare and relate to other stresses and their uncertainties? How can we characterize and use this uncertainty in our adaptation efforts?” Agencies should also consider climate change scenarios that have a low-probability of occurring but could significantly impact the agency’s mission and operations. The *Implementing Instructions* require agencies to participate in Council on Environmental Quality sponsored workshops to help them understand how climate is changing in the context of their own mission and disseminate information about relevant climate change impacts within the agency as appropriate. See Section IV.B for further discussion.

Apply understanding to agency mission and operations. At this step in the framework, agencies should be able to begin addressing how climate change impacts will affect agency mission and operations. Agencies' should consider the risks, vulnerabilities, and opportunities posed by climate change to their agency missions, programs, and operations. This is an essential part of the planning process that will enable an agency to set priorities for action and identify knowledge gaps. Agencies should also communicate science information needs to the appropriate Federal agencies to ensure that necessary climate change information meets adaptation planning needs across the Federal community. The *Implementing Instructions* require agencies to conduct a high-level analysis to begin to understand agency vulnerability to climate change. See Section IV.C for further discussion.

Develop, prioritize, and implement adaptive actions. At this stage of the flexible framework, agencies begin the process of developing and implementing an agency response to climate change risks and opportunities and begin to develop and consider a comprehensive set of potential climate change adaptation measures. Criteria for selecting priority adaptation activities and projects will vary from agency to agency based on agency operational aspects and programs. Agencies should also consider steps they will need to take to coordinate with other agency adaptation planning and interagency efforts to develop national adaptation plans, where appropriate. The *Implementing Instructions* require agencies to identify three to five priority actions for FY 2012 and to complete and submit an agency climate adaptation plan by June 2012. See Section IV.D for further discussion.

Evaluate and learn. Successful climate change adaptation requires ongoing monitoring and evaluation of efforts to continually assess the effectiveness of actions and adjust as necessary. Because of the uncertainties inherent in projecting future climate conditions, impacts, and responses and because our understanding of different types of adaptive actions is evolving, adaptation cannot be simply a policy or action that requires a one-time change. Adaptation plans should allow for a "feedback" mechanism, whereby new knowledge and information, lessons learned (including costs of implementation), and modified priorities can be accounted for and incorporated into the ongoing adaptation process. In 2011, agencies will be required to participate in Council on Environmental Quality sponsored workshops to share lessons learned with other agencies. See Section IV.E for further discussion.

Build awareness and skills. Building agency awareness and skills is central to ensuring the long term effectiveness of adaptation planning, implementation, and evaluation. This element of the framework builds agency capacity for understanding how climate change may impact agency operations and programs and how the agency can effectively address those impacts. . Building awareness and skills will require education and training, enabling structures, and leadership. Activities pursued under the other

elements of the planning framework, including participation in Council on Environmental Quality sponsored workshops, will help build awareness and skills needed for adaptation planning.

2. A Phased Approach

Federal agencies will need to take a phased approach to integrate adaptation planning into their programs and operations. As leadership and staff acquire and expand their knowledge of climate change and its impacts, agencies can assess how these impacts may affect their mission, programs, and operations. Once agencies have a greater understanding of global and national climate change trends and their implications, they can conduct a more detailed assessment of how their mission, priority programs, and operations may be impacted and identify specific program and project-level actions to prepare for and respond to climate change. While the *Implementing Instructions* are focused at high-level, agency-wide planning, the framework design supports planning efforts at both the agency- and project-level.

The *Implementing Instructions* establish a foundation for agencies to set measurable goals and commitments in the future, including: (1) more refined assessments of the vulnerabilities and opportunities created by climate change; and (2) specific adaptation actions to minimize risk and capitalize on these opportunities. Federal agencies are at different stages of adaptation planning. Some agencies may have already initiated actions required in the *Implementing Instructions*. These agencies are encouraged to undertake more detailed vulnerability assessments and implement specific actions to further incorporate adaptation into their programs, policies, and operations. However, all agencies are still required to meet the actions specified in the *Implementing Instructions*.

Agencies are also encouraged to participate in project-level (local to regional scale) adaptation planning activities, either within the agency or through interagency cross-cutting issue working groups.

Undertaking project-level adaptation activities will build awareness of the importance of adaptation and improve understanding of the adaptation planning process among agency staff and advance the next phase of agency-wide adaptation planning efforts.

3. Measurable Goals and Performance Metrics

The Task Force concluded that “agencies should identify measures to incorporate climate change-related considerations into existing agency planning processes, including the development of measurable goals and performance metrics to guide adaptation efforts and assess whether efforts are achieving desired

outcomes.”¹⁶ Regular evaluation of the success of the Federal Government in directly implementing and supporting adaptation efforts is crucial for continuously refining and improving adaptive approaches. An iterative agency evaluation process will allow adaptation plans, priorities, and actions to be revised as necessary if desired outcomes are not being achieved or if undesired consequences are occurring. While performance metrics are not required by the *Implementing Instructions*, agencies should adopt measurable goals and performance metrics for climate change adaptation.

E. ADAPTATION PLANNING AND THE STRATEGIC SUSTAINABILITY PERFORMANCE PLANNING PROCESS

Executive Order 13514 requires Federal agencies to develop Strategic Sustainability Performance Plans (Sustainability Plans) and include an evaluation of agency climate change risks and vulnerabilities to manage the effects of climate change on agency operations and mission in both the short- and long-term. The *Implementing Instructions* provide direction to agencies on how to conduct this evaluation and manage climate change impacts.

Agencies have flexibility on how to organize initial adaptation planning processes to best fit their missions and operations. Because climate change adaptation planning is a necessary and important part of sustainability planning, some agencies may choose to incorporate adaptation planning directly into their Sustainability Plan and their sustainability planning process. Some agencies, however, may choose to separate the adaptation planning process from their sustainability planning process.

Sustainability Plans are currently focused primarily on making agency operations sustainable through actions and quantitative reporting on various operational elements, such as the reduction of facility energy or water use. Adaptation planning addresses operational elements and also includes policy and program considerations. Adaptation planning allows agencies to understand, prepare for, and respond to how climate change may impact their mission and programs, as well as operational elements.

F. WHO SHOULD BE INVOLVED IN ADAPTATION PLANNING

As with any planning effort, effective adaptation planning should be an inclusive effort that considers the diverse concerns and expertise within the agency. Agencies should consider creating an adaptation planning team with representatives from the agency’s strategic planning, policy, operations, regional, and

¹⁶ *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*, October 5, 2010. pg. 26.

programmatic offices. Planning team members should have the authority to represent their office and/or program and have sufficient knowledge of the group's responsibilities and concerns to represent their issues effectively. The goal is to enable personnel and decision makers across the agency to appropriately integrate climate change planning into agency process and programs.

Some agencies have already initiated climate change adaptation planning are supporting the development of cross-cutting interagency plans related to water resources, coastal and ocean communities and ecosystems, and fish, wildlife and plants. Staff participating in interagency efforts for cross-cutting plans should also be knowledgeable about the agency specific planning efforts, especially as it relates to the cross-cutting plan (e.g., water resources). The cross-cutting interagency plans are discussed in Section H below.

G. SUPPORT FOR ADAPTATION PLANNING

The Office of the Federal Environmental Executive, working with the Agency Working Group and the U.S. Global Change Research Program, will identify tools and resources to support agencies' adaptation planning efforts and will generally make that information available on the FedCenter.gov website. Agencies are encouraged to contribute to this information sharing effort by providing resources and case studies or lessons learned to the FedCenter staff for inclusion in the website adaptation program area. Adaptation planning resources are also included as appendices to this document.

In 2011, the Council on Environmental Quality will also sponsor several workshops to support agency planning efforts and will provide a forum for agencies to share lessons learned.

H. COORDINATION, SHARING LESSONS, AND DEVELOPING COMMON APPROACHES

As agencies identify priority areas and set goals for their own climate change adaptation plans, it is critical that they coordinate with other appropriate agencies and interagency national planning efforts on adaptation issues that cut across agency jurisdictions. The Task Force specifically recommended developing national adaptation strategies for foreign assistance programs and cross-cutting issues including water resources management, coastal and ocean communities and ecosystems, and protection of fish, wildlife, and plants. Interagency efforts to implement these recommendations are underway and are described in more detail below. Agencies whose missions or programs intersect with these cross-cutting national adaptation plans should coordinate their adaptation plans with these efforts as appropriate.

Adaptation Planning that Cuts Across Federal Agencies

National Action Plan to Strengthen Climate Change Adaptation for Freshwater Resources: The Task Force report calls for the development of a national action plan to ensure an effective, well-coordinated, and sustained approach to adapt the Nation's freshwater resources to a changing climate. The Task Force's Water Resources Working Group is leading the development of this adaptation plan in coordination with other interagency water organizations. Based on the current timeline, the National Freshwater Resources adaptation plan is expected to be complete by July 2011.

Strategic Action Plan to Strengthen the Resilience of Coastal, Ocean, and Great Lakes Communities and Ecosystems: On July 19, 2010, President Obama signed an Executive Order establishing a National Ocean Policy that adopted the *Final Recommendations of the Interagency Ocean Policy Task Force*. Under the Executive Order, the interagency National Ocean Council is tasked with developing a strategic action plan to "strengthen resiliency of coastal communities and marine and Great Lakes environments and their abilities to adapt to climate change impacts and ocean acidification." The National Ocean Council formed an interagency team to develop the Coastal, Ocean, and Great Lakes Communities and Ecosystems strategic action plan by November 2011.

National Fish, Wildlife, and Plants Climate Adaptation Strategy: In a Fiscal Year 2010 Appropriations Act Conference Report, Congress specifically called for the development of a National Fish, Wildlife, and Plants Climate Adaptation Strategy. DOI (with the U.S. Fish and Wildlife Service as lead), NOAA, and CEQ are leading an intergovernmental effort to develop a national, government-wide strategy that provides a unified approach for action by governmental and non-governmental organizations to reduce the impacts of climate change on the Nation's species, habitats, and ecological processes. The National Fish, Wildlife, and Plants Climate Adaptation Strategy is scheduled to be completed by July 2012.

Federal Government-wide Strategy for U.S. Foreign Assistance Programs: The Task Force called on the Department of State, USAID, and the Department of the Treasury, working closely with other relevant Federal agencies, to develop a Federal Government-wide strategy that builds on and enhances on-going adaptation efforts, supports the core principles and objectives of the President's new Global Development Policy, and coordinates resources and expertise across the Federal Government to support international adaptation initiatives. The National Security Council, with support from the Council on Environmental Quality, is leading an interagency process to develop an international adaptation finance strategy that supports the Presidential Policy Directive on Global Development and outlines a strategic framework for deploying U. S. investments in international adaptation. The Foreign Assistance adaptation strategy is slated for completion in Spring 2011.

Coordination at the regional level is also important to implement activities efficiently and effectively. To improve coordination among Federal agencies on regional climate change adaptation, the Task Force recommended establishing regional climate change adaptation consortia. The Task Force is working with agencies to help facilitate this coordination. Many local, state, and Tribal governments and other groups are also actively adapting to climate change and agencies should coordinate with, build on, and learn from these efforts.

IV. IMPLEMENTING INSTRUCTIONS

All Federal agencies are required to complete the climate change adaptation planning actions listed in the *Implementing Instructions*. Figure 6 depicts these requirements in the context of the iterative Federal adaptation planning framework and the guiding principles for adaptation planning.

Federal Agency Climate Change Adaptation

Planning Actions, Planning Framework, and Guiding Principles

Apply Guiding Principles:

- Adopt integrated approaches.
- Prioritize the most vulnerable.
- Use best-available science.
- Build strong partnerships.
- Apply risk-management methods and tools.
- Apply ecosystem-based approaches.
- Maximize mutual benefits.
- Continuously evaluate performance.

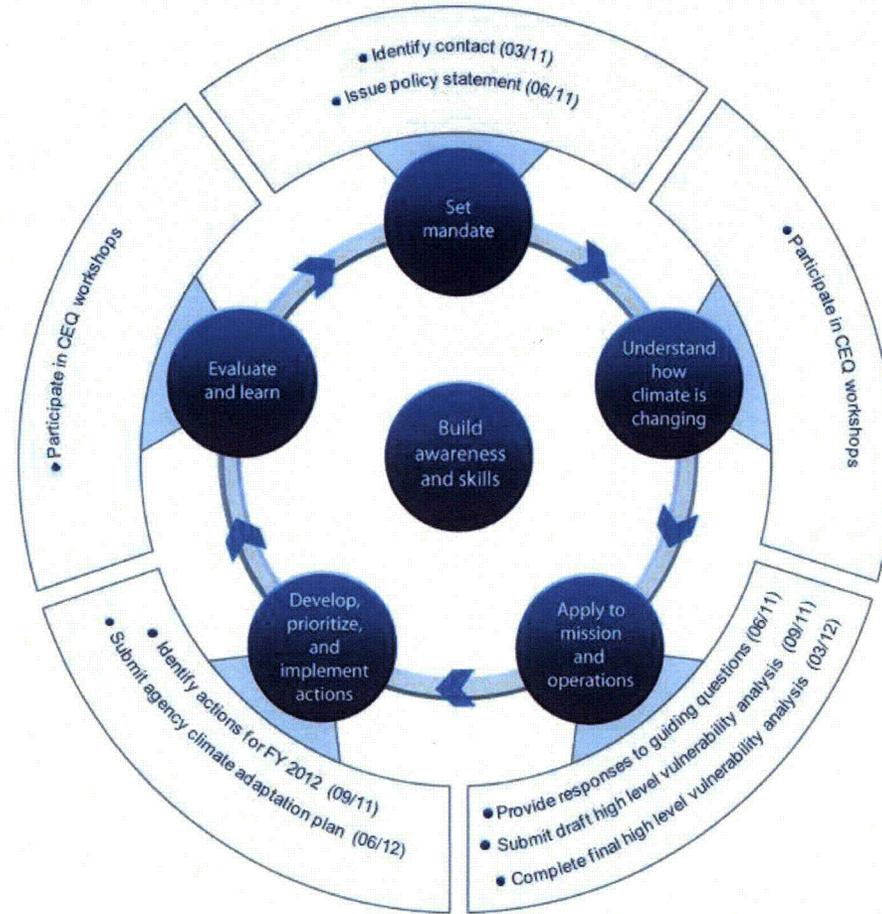


Figure 6. Federal agency climate change adaptation planning actions in the context of the Federal adaptation planning framework.

A. ESTABLISH A MANDATE AND POLICY

The first stage of the planning process is to establish an agency mandate and policy to support the development and implementation of climate change adaptation planning.

As required by the *Implementing Instructions*, the head of each agency must identify to the Chair of the Council on Environmental Quality a senior official responsible for agency climate change adaptation planning actions required by the *Implementing Instructions*. The individual must be a senior agency official who will formally represent the agency on adaptation planning issues. This person may be the agency's Senior Sustainability Official or another appropriate official as determined by the head of the agency. The individual will serve as the point of contact for communications from the Council on Environmental Quality and be responsible for submitting adaptation planning requirements to the Chair of the Council on Environmental Quality and the Director of the Office of Management and Budget as appropriate.

Action: By April 15, 2011, identify to the Chair of the Council on Environmental Quality a senior official responsible for carrying out the climate change adaptation planning actions required by these *Implementing Instructions*.

Agencies are also required to establish an agency policy statement that commits the agency to climate change adaptation planning. The policy statement must be signed by the head of the agency and distributed throughout the agency. The policy statement must also be made publicly available to affirm the agency's commitment to adaptation planning.

Action: By June 3, 2011, concurrent with submission of the agency Strategic Sustainability Performance Plan, issue and make publicly available an agency-wide climate change adaptation policy statement, signed by the head of the agency, which commits the agency to adaptation planning to address challenges posed by climate change risks to the agency's mission, programs, and operations.

As noted in the *Implementing Instructions*, the policy statement must:

- a) state the purpose of the policy, including both the agency's vision for successful adaptation planning and initial adaptation goals as well as recognition that climate change adaptation is a critical complement to climate change mitigation and that both are required to address the causes and consequences of climate change;

- b) adopt the Interagency Climate Change Adaptation Task Force’s guiding principles and framework for adaptation planning;¹⁷
- c) describe the agency process to ensure effective adaptation planning implementation, including how the agency will coordinate adaptation planning across programs and operations within the agency as well as with other agencies on climate change adaptation matters of common interest; and
- d) identify programs and resources within the agency to support the climate change adaptation planning process.

The *Implementing Instructions* require that agencies review and update their adaptation policy as necessary. A model policy statement is provided in Appendix C. Appendix D provides an example of the Department of the Interior’s policy statement for adaptation planning.

B. INCREASE UNDERSTANDING OF HOW THE CLIMATE IS CHANGING

To help agencies better understand how the climate is changing, the Council on Environmental Quality will provide workshops for Federal agency personnel. As planning progresses, agencies will need to collect and share information within their agency about how climate change will impact mission, programs, and operations. Agency leadership, program directors, and other key staff should have an understanding of climate change impacts to assess whether there is a need for adaptive actions in their own programs or operations.

Action: During calendar year 2011, participate in interagency climate change workshops sponsored by the Council on Environmental Quality. Each agency shall collect and share within the agency and across major program elements, information relevant to impacts of climate change on agency mission, programs, and operations and pursue opportunities for sharing and coordination across the Federal community.

¹⁷ *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*, October 5, 2010. See pg. 10 for the guiding principles and pg. 27 for framework for the adaptation planning. The guiding principles are also reprinted on pg. 17 of the *Support Document* and the framework is discussed on pg. 18.

C. APPLY UNDERSTANDING TO AGENCY MISSION AND OPERATIONS

The *Implementing Instructions* require agencies to complete a high-level analysis of their agency's vulnerability to climate change. This analysis will ensure that agencies identify priorities for future assessment and implementation action. This analysis is not intended to be a detailed vulnerability assessment of specific programs, projects, or geographic regions but should provide initial awareness of potential climate change impacts to agency operations, policies and programs. Appendix E. provides questions designed to guide agencies through the initial stage of assessment. Agencies are required to submit responses to these questions to the Chair of the Council on Environmental Quality. The responses agencies submit in June 2011 are draft documents that will not be included or released with the agency's June 2011 Sustainability Plan.

Action: By June 3, 2011, concurrent with submission of the agency Strategic Sustainability Performance Plan, submit to the Chair of the Council on Environmental Quality agency responses to the guiding questions provided in Appendix E. The guiding questions are specifically designed to allow agencies to begin assessing how climate change will affect agency mission, programs, and operations and to prepare the agency to undertake a high-level analysis of agency vulnerability to climate change.

Agency responses to the guiding questions should provide a foundation for the agency high-level analysis. The Council on Environmental Quality will introduce the high-level analysis during its summer 2011 workshops and will provide additional assistance to agencies to help them complete the analysis. Agencies will use the feedback and additional information they receive during the workshops to develop the high-level analysis. Agencies will submit a draft analysis to the Chair of the Council on Environmental Quality in September 2011 and complete their high-level analysis by March 2012.

Action: By September 30, 2011, submit to the Chair of the Council on Environmental Quality a preliminary high-level analysis of agency vulnerability to climate change.

Action: By March 2012, for the purpose of informing the climate adaptation planning document required under section D(2) of these instructions, complete a final high-level analysis of agency

vulnerability to climate change. Additional information and instructions to complete the high-level analysis will be provided during Council on Environmental Quality sponsored interagency workshops, or in future guidance or support documents.

D. DEVELOP, PRIOTIZE, AND IMPLEMENT ACTIONS

The initial high-level analysis process should provide agencies with information on necessary preliminary agency actions to inform the planning process. To continue this approach, the *Implementing Instructions* require agencies to identify three to five priority climate change adaptation actions that the agency will implement in FY 2012.

Action: By September 30, 2011, concurrent with the submission of agency preliminary high-level analysis required under section C(2) of these instructions, and using the template in Appendix G of the *Support Document*, identify and submit to the Chair of the Council on Environmental Quality three to five priority climate change adaptation actions that the agency will implement in fiscal year 2012, including actions to improve agency capacity to assess and build resilience to climate change risks.

Appendix G provides a template for this submission. Agencies should identify actions that will help build their capacity to develop a formal climate change adaptation plan by June 2012. For example, actions could include: a) steps the agency will take to develop the agency climate adaptation plan; b) select programs planned or underway to address known climate change risks; and c) steps the agency will take to coordinate with other agency adaptation planning and national adaptation planning efforts. Because agencies will have already completed their budgeting process for FY 2012, they are not expected to undertake projects requiring new resources.

With the benefit of lessons learned from the priority actions, the completed high-level analysis and other considerations, agencies are required to complete a formal climate adaptation action plan by June 2012 to be submitted as part of the Executive Order 13514 Sustainability Plan submission.

Action: By June 4, 2012, as part of the agency Strategic Sustainability Performance Plan, submit to the Chair of the Council on Environmental Quality and the Director of the Office of Management and Budget the agency climate adaptation plan for implementation in fiscal year

2013. The plans should reflect and advance, where appropriate, interagency cross-cutting National adaptation planning efforts. Guidance and instructions to complete the agency climate adaptation plan will be provided to agencies during relevant Council on Environmental Quality sponsored interagency workshops or in future guidance documents.

The agencies will submit agency climate change adaptation plans in June 2012. These plans can be developed as part of the agency Sustainability Plans or referenced in and submitted alongside the agency Sustainability Plan. The high-level analysis will help inform the priorities and strategic actions in the agency plan. Revisiting the plan and incorporating new information on climate change and adaptive actions will be an important part of effective adaptation planning and implementation. Detailed information regarding the required elements of the June 2012 climate adaptation plans will be provided in future guidance and supporting materials.

To ensure transparency and inform the public about agency climate adaptation planning, the climate change adaptation plans are required to be made public once the Sustainability Plans have been reviewed and released for public distribution by the Office of Management and Budget. In addition, the Council on Environmental Quality will provide guidance to agencies regarding necessary revisions to climate change adaptation plans in coordination with guidance on the Sustainability Plans.

Action: When the agency Strategic Sustainability Performance Plan is approved for public release by the Office of Management and Budget, agencies shall ensure that the climate adaptation portion of the plan is made publically available for review and comment. Agencies shall update the plan as appropriate in accordance with Council on Environmental Quality guidance for submission of agency Strategic Sustainability Performance Plans.

E. EVALUATE AND LEARN

To facilitate the learning process during the first phase of adaptation planning discussed in these *Implementing Instructions*, the Council on Environmental Quality will sponsor several workshops on the adaptation planning requirements and provide opportunities for agencies to learn from one another and exchange ideas. See Section III.G for additional discussion on the types of workshops that may be held.

Action: During calendar year 2011, participate in interagency workshops sponsored by the Council on Environmental Quality to share lessons learned with other agencies.

V. CONCLUSION

Climate change will directly affect the Federal Government, the communities we serve, and the infrastructure, lands, and waters we manage and protect. As directed by Executive Order 13514, Federal agencies must prepare for and respond to the changing climate so that their services, programs, and operations will continue to be effective. The Federal Government must also lead by example. The *Implementing Instructions* for Federal agency adaptation planning and this supplemental Support Document are a critical first step in this process. Establishing a policy statement, conducting a high-level analysis of how climate change will impact their ability to fulfill their mission and program goals and carry out operations, and developing an agency climate adaptation plan will provide agencies with a solid foundation for moving forward with climate change adaptation.

Climate change adaptation is an iterative process. Over the next year, the Office of the Federal Environmental Executive will continue to work with the Office of Management and Budget and the Agency Working Group to develop resources and guidance to further guide agencies as they move towards achieving the long-term goal of integrating climate change adaptation into their programs, policies, and operations.

**APPENDIX A. Summary of Policy Goals and Recommended Actions from 2010
Interagency Climate Change Adaptation Task Force Progress Report**

- 1. Encourage and Mainstream Adaptation Planning across the Federal Government** – *Climate change will challenge the mission, operations, and programs of nearly every Federal agency. Ensuring that the Federal government has the capacity to execute its missions and maintain important services in the face of climate change is essential.*
 - Implement adaptation planning within Federal agencies
 - Employ a flexible framework for agency adaptation planning
 - Use a phased and coordinated approach to implement agency adaptation

- 2. Improve Integration of Science into Decision Making** – *Access to integrated, interdisciplinary science is critical to understanding potential climate change impacts, and informing the development, implementation, and evaluation of response strategies.*
 - Create a “roadmap” of existing Federal science efforts that inform and support adaptation
 - Prioritize activities that address science gaps important to adaptation decisions and policies
 - Build science translation capacity to improve the communication and application of science to meet the needs of decision makers
 - Explore approaches to develop an online data and information clearinghouse for adaptation

- 3. Address Key Cross-Cutting Issues** – *The breadth of certain climate change impacts creates challenges that cut across the jurisdictions and missions of individual Federal agencies. Addressing these issues will require a collaborative approach along with coordination and partnerships at the local, state, Tribal, and regional levels. The Task Force focused on an initial set of cross-cutting issues and recommends the following actions:*
 - Improve water resource management in a changing climate**
 - Strengthen data and information systems for understanding climate change impacts on water
 - Improve water-use efficiency to reduce climate change impacts
 - Develop a national action plan to strengthen climate change adaptation for freshwater resources

 - Protect human health by addressing climate change in public health activities**
 - Enhance the ability of Federal decision makers to incorporate health considerations into adaptation planning
 - Build integrated public health surveillance and early warning systems to improve detection of climate change health risks
 - Promote resilience of individuals and communities to climate-related health risks

Build resilience to climate change in communities

- Ensure relevant Federal regulations, policies, and guidance demonstrate leadership on community adaptation
- Integrate adaptation considerations into Federal programs that affect communities

Facilitate the incorporation of climate change risks into insurance mechanisms

- Explore a public/private partnership to produce an open-source risk assessment model

Address additional cross-cutting issues

- Develop a strategic action plan focused on strengthening the resilience of coastal, ocean, and Great Lakes communities and ecosystems to climate change
- Develop a strategy for reducing the impacts of climate change on the Nation's fish, wildlife, and plant resources and their habitats¹

4. Enhance Efforts to Lead and Support International Adaptation – *Climate change poses risks and opportunities that are important to many of the U.S. Government's international development, security, and diplomatic priorities. Climate change adaptation should be a core consideration in the design and implementation of U.S. foreign assistance activities. Agencies should enhance collaboration to support international adaptation objectives.*

- Develop a Government-wide strategy to support multilateral and bilateral adaptation activities and integrate adaptation into relevant U.S. foreign assistance programs
- Enhance collaboration on adaptation among international development, national security, and technical support agencies
- Engage global development partners and the private sector to promote knowledge sharing and coordinate investments

5. Coordinate Capabilities of the Federal Government to Support Adaptation – *The Federal government should improve coordination of its science, services, and assessments to better support stakeholders.*

- Build and maintain strong partnerships to increase responsiveness of Federal government activities to support local, state, and Tribal needs
- Develop regional climate change adaptation consortia among Federal agencies
- Establish performance metrics for evaluating Federal adaptation efforts

¹ Pursuant to Congressional direction, development of a national plan to address fish, wildlife, and plant resources is already underway.

APPENDIX B. Interagency Climate Change Adaptation Agency Working Group Membership

Co-chairs

Department of Housing and Urban Development
Environmental Protection Agency

Members

Centers for Disease Control
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Homeland Security
Department of the Interior
Department of Transportation
Federal Emergency Management Agency
Office of the Federal Environmental Executive
Office of Management and Budget
U.S. Army Corps of Engineers
U.S. Agency for International Development
U.S. Global Change Research Program

APPENDIX C. Model Policy Statement for Climate Change Adaptation

I. Background:

- a) While the scope, severity and pace of future climate change impacts are difficult to predict, it is clear that potential changes could have important impacts on our Agency's ability to fulfill its mission. Climate change adaptation is a critical complement to mitigation; both are required to address the causes and consequences of climate change.
- b) Adaptation planning will allow the Agency to minimize negative impacts of climate change that are already occurring and take advantage of any new opportunities.
- c) Through adaptation planning, the Agency will identify how climate change is likely to impact our ability to achieve our mission, operate our facilities, and meet our policy and program objectives. Through adaptation planning the Agency will develop, prioritize, implement, and evaluate actions to moderate climate change risks and exploit any new opportunities that climate change may bring.
- d) By integrating climate change adaptation strategies into our programs and operations, the Agency better ensures that tax-payer resources are invested wisely and Agency services and operations remain effective in current and future climate conditions.
- e) Through climate adaptation planning, the Agency is contributing to the Federal Government's leadership role in sustainability and pursuing the vision of a resilient, healthy, and prosperous Nation in the face of a changing climate.

II. Directive:

- a) The goal of this policy is to ensure that the Agency executes its mission and operations securely, effectively, and efficiently as the climate continues to change.
- b) This policy establishes an Agency-wide directive to integrate climate change adaptation planning and actions into Agency programs, policies, and operations.
- c) The Agency shall undertake climate change adaptation planning, in consultation with the Agency's components [or Offices], and implement the results of that planning using best available science and information.
The Agency shall consider potential climate change impacts when undertaking long-term planning, setting priorities for scientific research and investigations, and making decisions affecting Agency resources, programs, policies, and operations.
- d) The Agency shall develop and publish an agency-wide climate adaptation plan by June 2012 [or earlier] and update it regularly. The plan shall include each of the Agency's components [or Offices] as appropriate and incorporate the findings and directives of this policy statement. The plan will identify how climate change may impact the Agency's ability to achieve its mission, programs, policies and operations. The plan will identify and prioritize actions and establish a mechanism to evaluate progress and continue to improve the Agency's capacity to effectively adapt to current and future changes in the climate.
- e) Each Agency component [or Office] shall, in a manner consistent and compatible with its mission:

i. analyze how climate change may impact its ability to achieve its mission, policy, program, and operation objectives by reviewing existing programs, operations, policies, and authorities to: (1) identify potential impacts of climate change on the component's areas of responsibility; (2) prioritize and implement response actions; and (3) continuously assess and improve capacity to adapt to current and future changes in the climate.

ii. identify to [Budget Department] through the Agency's annual budget process areas where budget adjustments are necessary to carry out the actions identified under this Policy.

iii. identify for the [Legal Department] areas where legal analysis is needed to carry out Agency actions identified under this Policy.

iv. coordinate actions with the Agency Climate Change Adaptation Steering Group/Working Group established in Section III below.

f) The Agency shall fully implement the climate change adaptation *Implementing Instructions* issued by the White House Council on Environmental Quality under Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, and other applicable authorities.

g) The Agency will apply the guiding principles and planning framework for climate change adaptation found in the October 5, 2010, *Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*.

h) The Agency will coordinate with other agencies and interagency efforts, including the Interagency Climate Change Adaptation Task Force, on climate change adaptation issues that cut across agency jurisdictions, including areas where national adaptation plans are being or have been developed, and will identify a process for sharing climate change adaptation planning information throughout the agency and the public.

III. Agency Coordination and Implementation

a. The [XX Senior Executive] is responsible for ensuring implementation of all aspects of this Policy. This policy does not alter or affect any existing duty or authority of individual components or Offices.

b. Through this Policy Directive, the Secretary establishes the Agency Climate Change Adaptation Steering Committee/Work Group to oversee and coordinate agency-wide climate change adaptation planning and implementation. The Steering Committee/Work Group is chaired by [XX Official] and will include representation from each Component and/or Office as appropriate.

c. This Policy Directive is effective immediately and will remain in effect until it is amended, superseded, or revoked.

APPENDIX D. Department of the Interior's Policy Statement for Climate Change Adaptation

THE SECRETARY OF THE INTERIOR

Washington

ORDER NO. 3289, Amendment No. 1 (*Amended material italicized*)

SIGNATURE DATE: February 22, 2010

Subject: Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources

Sec. 1 Purpose and Background. Secretarial Order No. 3285, issued on March 11, 2009, made production and transmission of renewable energy on public lands a priority for the Department. This Order establishes a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages. This Order replaces Secretarial Order No. 3226, Amendment No. 1, issued on January 16, 2009, and reinstates the provisions of Secretarial Order No. 3226, issued on January 19, 2001.

To fulfill our nation's vision for a clean energy economy, Interior is now managing America's public lands and oceans not just for balanced oil, natural gas, and coal development, but also – for the first time ever – to promote environmentally responsible renewable energy development. Sun, wind, biomass, and geothermal energy from our public and tribal lands is creating new jobs and will power millions of American homes and electric vehicles.

The Department is also taking the lead in protecting our country's water, land, fish and wildlife, and cultural heritage and tribal lands and resources from the dramatic effects of climate change that are already occurring – from the Arctic to the Everglades. The realities of climate change require us to change how we manage the land, water, fish and wildlife, and cultural heritage and tribal lands and resources we oversee. For example:

- New water management imperatives associated with climate change may require restoration of natural systems and construction of new infrastructure to reduce new flood risks or to capture early run-off.
- Strategies to address sea level rise may require acquisition of upland habitat and creation of wetlands and other natural filters and barriers to protect against sea level rise and storm surges. It may be necessary to relocate certain iconic and culturally historic structures.
- Shifting wildlife and habitat populations may require investments in new wildlife corridors.
- New invasions of exotic species and new wildland fire threats due to longer fire seasons and more severe droughts will require innovation and more effective ways of managing the Department's resources.

The Department of the Interior, with its 67,000 employees and scientific and resource management expertise, is responsible for helping protect the nation from the impacts of climate change. In particular the Department must:

- Adapt its water management strategies to address the possibility of shrinking water supplies and more frequent and extended droughts to continue to supply drinking water to more than 31 million people and irrigation water to 140,000 farmers.
- Wisely manage millions of acres of parks, refuges and other public lands, and prudently exercise its shared responsibility for managing the 1.7 billion acres of the U.S. outer continental shelf.
- Conserve and manage fish and wildlife resources, including over 800 native migratory bird species and nearly 2,000 federally listed threatened and endangered species.
- Protect cultural and archaeological resources and iconic structures that may be affected by climate change.
- Address the impacts of climate change on American Indians and Alaska Natives, for whom the Department holds trust responsibilities on behalf of the Federal Government.
- Continue to provide state-of-the art science to better understand the impacts of climate change and to develop science-based adaptive management strategies for natural and cultural resource managers.
- Continue its work to quantify the amount of carbon stored in our forests, wetlands, and grasslands, identifying areas where carbon dioxide can be safely stored underground, and ways to reduce the Department's carbon footprint.

Sec. 2 **Authority.** This Order is issued under the authority of Section 2 of Reorganization Plan No. 3 of 1950 (64 Stat. 1262), as amended.

Sec. 3 **Coordinating the Department's Response to Climate Change Impacts on Our Resources.** *The Climate Change Response Council within the Office of the Secretary is renamed the Energy and Climate Change Council (Council).* *The Council* will execute a coordinated Department-wide strategy to address *renewable energy efforts and* to increase scientific understanding of and development of effective adaptive management tools *to address* the impacts of climate change on our natural and cultural resources. The *Energy and Climate Change Council* will be composed of the Secretary (Chair), Deputy Secretary (Vice-Chair), Counselor to the Secretary (Vice-Chair), Assistant Secretaries, Bureau Directors and the Solicitor. The Council will help coordinate activities within and among the Department's agencies and bureaus to develop and implement an integrated strategy for responding to *renewable energy efforts and* climate change impacts involving the resources managed by the Department. The Department's *Energy and Climate Change Council* will also coordinate its *energy and* climate change activities with all relevant Federal Departments and agencies including, but not limited to, the Council on Environmental Quality, the Office of Energy and Climate Change, the Office of Science and Technology Policy, the National Science and Technology Council, the Department of Agriculture, the Department of Commerce, the Department of Defense, and the Environmental Protection Agency.

The *Energy and Climate Change Council* will implement Department-specific *energy activities as described in Secretarial Order # 3285 (Amendment No. 1), and implement* climate change activities through the following mechanisms:

- a. Climate Change Planning Requirements. Each bureau and office of the Department must consider and analyze potential climate change impacts when undertaking long-range planning exercises,

setting priorities for scientific research and investigations, developing multi-year management plans, and making major decisions regarding potential use of resources under the Department's purview. These requirements were set forth in Secretary's Orders No. 3226 and 3285, and remain in effect. The organizational changes made by this Order will enable the bureaus and agencies to fulfill these planning requirements.

b. *DOI Climate Science Centers*. Management decisions made in response to climate change impacts must be informed by science and require that scientists work in tandem with those managers who are confronting climate change impacts and evaluating options to respond to such impacts. Pursuant to P.L. 110-161, the United States Geological Survey (USGS) has been developing regional science centers to provide climate change impact data and analysis geared to the needs of fish and wildlife managers as they develop adaptation strategies in response to climate change. These centers are currently known as "regional hubs" of the National Climate Change and Wildlife Science Center, and are being developed in close collaboration with Interior agencies and other federal, state, university, and non-governmental partners.

The Energy and Climate Change Council will work with USGS and other Department bureaus to rename these regional science centers as *DOI Climate Science Centers (Centers)* and broaden their mandate to encompass other climate-change-related impacts on Departmental resources. These eight Centers will synthesize and integrate climate change impact data and develop tools that the Department's managers and partners can use when managing the Department's land, water, fish and wildlife, and cultural heritage resources.

c. *Landscape Conservation Cooperatives*. Given the broad impacts of climate change, management responses to such impacts must be coordinated on a landscape-level basis. For example, wildlife migration and related needs for new wildlife corridors, the spread of invasive species and wildfire risks, typically will extend beyond the borders of National Wildlife Refuges, BLM lands, or National Parks. Additionally, some bureau responsibilities (e.g., Fish and Wildlife Service migratory bird and threatened and endangered species responsibilities) extend nationally and globally. Because of the unprecedented scope of affected landscapes, Interior bureaus and agencies must work together, and with other federal, state, tribal and local governments, and private landowner partners, to develop landscape-level strategies for understanding and responding to climate change impacts. Interior bureaus and agencies, guided by the *Energy and Climate Change Council*, will work to stimulate the development of a network of collaborative "Landscape Conservation Cooperatives." These cooperatives, which already have been formed in some regions, will work interactively with the relevant *DOI Climate Science Center(s)* and help coordinate adaptation efforts in the region.

Sec. 4 Additional Departmental Action to Mitigate Climate Change. In accordance with Secretarial Order No. 3285, the Department has prioritized development of renewable energy on public lands and offshore waters to reduce our dependence on foreign oil and to reduce greenhouse gas pollution. This Order establishes two additional projects to mitigate climate change: the DOI Carbon Storage Project, and the DOI Carbon Footprint Project. Additional mitigation projects will be encouraged and supported by the *Energy and Climate Change Council*.

a. *The DOI Carbon Storage Project*. This project is being implemented under P.L. 110-140, "The Energy Independence and Security Act of 2007," which gives the Department statutory responsibility to develop carbon sequestration methodologies for geological (i.e., underground) and

biological (e.g., forests and rangelands) carbon storage. The USGS has the lead in administering the Carbon Storage Project, but will work closely with other bureaus and agencies in the Department and external partners to enhance carbon storage in geologic formations and in plants and soils in a manner consistent with the Department's responsibility to provide comprehensive, long-term stewardship of its resources. The DOI Carbon Storage Project is vital for successful domestic and global geological and biological carbon sequestration efforts.

b. The DOI Carbon Footprint Project. The project will develop a unified greenhouse gas emission reduction program, including setting a baseline and reduction goal for the Department's greenhouse gas emissions and energy use. The Assistant Secretary for Policy, Management and Budget will have the lead in administering the DOI Carbon Footprint Project, with the cooperation of all of the Department's agencies and bureaus.

Sec. 5 American Indians and Alaska Natives. Climate change may disproportionately affect tribes and their lands because they are heavily dependent on their natural resources for economic and cultural identity. As the Department has the primary trust responsibility for the Federal Government for American Indians, Alaska Natives, and tribal lands and resources, the Department will ensure consistent and in-depth government-to-government consultation with tribes and Alaska Natives on the Department's climate change initiatives. Tribal values are critical to determining what is to be protected, why, and how to protect the interests of their communities. The Department will support the use of the best available science, including traditional ecological knowledge, in formulating policy pertaining to climate change. The Department will also support substantive participation by tribes in deliberations on climate-related mechanisms, agreements, rules, and regulations.

Sec. 6 Implementation. The Deputy Secretary is responsible for ensuring implementation of all aspects of this Order. This responsibility may be delegated as appropriate. This Order does not alter or affect any existing duty or authority of individual bureaus.

Sec. 7 Effective Date. This Order is effective immediately and will remain in effect until its provisions are converted to the Departmental Manual or until it is amended, superseded, or revoked, whichever occurs first.

/s/ Ken Salazar
Secretary of the Interior

SO#3289A1 2/22/10

APPENDIX E. Guiding Questions for Agency Adaptation Planning

How Will Climate Change Impact Agency Mission and Operations?

The guiding questions below are designed to help agencies begin to assess how climate change will affect their operations and ability to achieve their mission, policies and program goals. The climate is changing and these changes are causing and will continue to cause a cascade of effects that may impact agency performance. For example, changes in precipitation patterns may cause drought which leads to water scarcity and decreased availability of water for drinking, irrigation, and the environment. These impacts could, in turn, lead to crop failures, damages to drought-intolerant species, and reduced electricity production from hydroelectric plants. These impacts may have immediate consequences for programs and operations of a number of Federal agencies and will likely have significant long-term impacts on nearly all Federal agencies.

Agencies' initial responses to the guiding questions will prepare them to undertake a high-level analysis to further understand their agencies' vulnerability to climate change. The Council on Environmental Quality will address this topic during workshops in summer 2011. The workshops will provide agencies with an opportunity to discuss their preliminary responses and provide additional instructions and requirements for finalizing the high-level analysis.

Instructions:

1. Read recommended reference materials in Appendix J and the list of climate change impacts provided in Appendix F, and review additional literature and consult climate change experts, as necessary.
2. Discuss with your agency's strategic planning and/or operational points of contacts as well as other senior leaders, as appropriate, how climate change impacts may affect your mission, goals, and operations based on the guiding questions below.
3. Based on your review and discussions, respond to the questions below. Please consider all plausible climate change impacts when responding to the questions. *Responses should be between one and three pages.*

Each agency should be prepared to discuss their responses at a Council on Environmental Quality sponsored training workshop in Summer 2011.

Questions:

1. **How is climate change likely to affect the ability of your agency to achieve its mission and strategic goals?**

Agencies should consider how climate change impacts the agency's strategic plan (or related long-term planning document/guidance). This question is meant to trigger a high-level evaluation, not a comprehensive examination of all agency programs and operations. To answer this question, please respond to the three subparts below.

- a) To focus your response, identify at least three of your agency's strategic goals or objectives to evaluate. (You can elect to work on more than three goals at this time if you wish, although it is not required. At a later date, you will be required to evaluate all relevant goals.)

You may find your strategic goals are too broad to evaluate effectively in which case you should select three strategic objectives instead.

The agency strategic goals or objectives selected for this exercise are:

Goal/Objective 1:

Goal/Objective 2:

Goal/Objective 3:

- b) For each goal or objective listed above, identify major climate change impacts that may significantly impact your agency’s ability to meet the goal or objective. Briefly describe how these impacts affect your selected goals or objectives. *Some examples of climate change impacts are provided in Appendix F. Note that this is not an exhaustive list. After reviewing the recommended literature, you may wish to identify a climate change impact that is not listed in Appendix F. Consider how each goal or objective is impacted by climate change. Also consider if the impacts of climate change could undermine or support your agency’s ability to successfully achieve the selected goals or objectives.*
 - c) What steps, if any, has your agency taken to manage the effects of climate change on the selected goals or objectives?
2. **How can your agency coordinate and collaborate with other agencies to better manage the effects of climate change?** *In some cases, climate change impacts cut across Federal agencies’ missions and operations, for example, those related to water resource management, public health, and communities. Agencies can improve their effectiveness in developing climate change adaptation measures and leveraging resources by coordinating and collaborating on cross-cutting issues. The tables below may help guide your response.*
- a) Identify Federal agencies that are likely to face similar climate change impacts and management challenges to your agency. Describe how their management challenges are similar to yours.

Agency	How Climate Change Management Challenges are Similar

- b) Is your agency already collaborating with other agencies to develop strategies to adapt to climate change impacts that cut across agency mission and operations? If so, identify the agencies and briefly describe the collaboration or project? If your agency is engaged in many collaboration activities, select a few of the most significant.

Agency	Existing Collaboration/Project

- c) Identify and describe opportunities for new or additional collaboration activities with other agencies to leverage resources and develop consistent adaptation strategies.

Agency	Potential Collaboration/Project

APPENDIX F. Examples of Climate Change Impacts by Sector

Below are examples of climate change impacts by sector. The information is adapted and reprinted with permission from the National Academies of Sciences report, *Adapting to the Impacts of Climate Change* © 2010 by the National Academy of Sciences, Courtesy of the National Academies Press, Washington, D.C. For the complete report and examples of adaptation actions to address each impact, go to: <http://americasclimatechoices.org/paneladaptation.shtml>.

Please note that some cross-cutting topics are not fully explored in sectoral analyses, including cultural resources and social, economic, and institutional structures and frameworks.

Sector: Ecosystems	
<i>Climate Change</i>	<i>Impact</i>
Altered hydrologic regime	Water stress on ecosystems
	Flow effects on rivers
More extreme events	Increased wildfire
Climate change generally	Degradation of ecosystems
	Problems for native species
	Threats to ecosystem services
	Outdated management
Sector: Agriculture and Forestry	
<i>Climate Change</i>	<i>Impact</i>
Increased evaporation and changes in precipitation; Increased precipitation	Greater irrigation requirements
	Increased yields of rain-fed agriculture
	Impacts to tree viability
Sea level rise	Brackish water infiltrating coastal farmland
Increased temperature: effects on pests	Greater spread of animal diseases from low- to mid-latitudes due to warming
	Northern migration of weeds
	Disease pressure on crops and livestock will increase with earlier springs and warmer winters, allowing low proliferation and higher survival rates of pathogens and parasites
Increased temperature: effects on livestock	Climate change induced shifts in plant productivity and type will impact livestock operations
	Higher temperature will likely reduce livestock production during the summer; partially offset by warmer winters
Increased temperature: effects on crops	Increased temperature will lengthen growing season, extending forage production season and decreasing the need for winter season forage reserves
	Crops near climate thresholds, like grapes, may decrease in yield and/or quality
	Improved climate for fruit production in Great Lakes region and eastern Canada but with risks of early season frost and damaging winter thaws
	High temperatures during flowering may reduce grain number, size, and quality; Pollen sterilization by extreme temperatures
	Possible changes in length of growing season and in growth rates changing the required growing season
Possible changes in sensitivity of plants to fertilizers, pesticides, and	

	herbicides
Higher atmospheric CO ₂ concentrations	Increased production of some trees and crops
	Stresses will accumulate over time
	Selective advantages for C3 weeds: greater competition with crops
Extreme events	Increased climate extremes may promote plant disease and pest outbreaks
	Increased risk of flood in some regions
	More frequent extreme events may lower yields by directly damaging crops at specific developmental stages, like flowering, or making the timing of field applications more difficult
	Decrease in snow cover and more winter rain on bare soil lengthen erosion season and enhance erosion
	Forest fires will become more common as climate becomes hotter and drier
	Point and non-point source pollution from agriculture practices could increase
Climate change generally	Need for more intense management
	Potential new markets and new competition; need to adapt to mitigation measures
	Impacts to ecosystem services
	Loss of crop yields
Sector: Water	
<i>Climate Change</i>	<i>Impact</i>
Higher temperature and reduced precipitation	Insufficient water supplies
	Inadequate water for ecosystems
	Decreased snow pack in West and Northeast
Changed seasonality of precipitation	More variable streamflow and lake levels
Storm surges, sea level rise, and increasing intensity of precipitation	Increased frequency of coastal and riverine flooding
	Increased levels of pollutants in runoff
	Increased storm water runoff
Higher water temperature	Ecological effects
	Increased organic material in public water supplies
	More stratification in lakes
Sea level rise	Saline intrusion into coastal aquifers
	Saline intrusion into estuaries, inundation of coastal wetlands
Climate change generally	Landscape impacts on water supply
	Outdated institutions in light of changing conditions
Sector: Health	
<i>Climate Change</i>	<i>Impact</i>
Changes in frequency, intensity, and duration of extreme weather events (i.e. floods, droughts, windstorms, wildfires)	Increased risk of injuries, illnesses, and death
Increases in frequency, intensity, and duration of	Increased risk of heat-related illnesses and deaths

heat waves	
Warmer temperatures on cloudless days	Increased risks of adverse health outcomes related to poor air quality
Changes in mean and extreme temperature and precipitation	Changes in geographic range and incidence of vectorborne and zoonotic diseases
	Changes in geographic range and incidence of waterborne and foodborne diseases
Climate change generally	Institutional challenges
Sector: Transportation	
<i>Climate Change</i>	<i>Impact</i>
Long-term sea level rise	Permanent flooding of coastal land
	Loss of barrier islands
	Impacts on infrastructure such as bridges or harbors
New patterns of prevailing winds	Existing airport runways may become less efficient
	Time of travel on long-distance flights and transoceanic shipping may be affected
More intense precipitation	Change in hydrology
	Change to hydraulics
	More frequent flooding
	Changes in efficiency of some transportation modes; change in safety (or perception of safety) in some transportation modes
Warmer temperatures and heat waves	Stress on pavement and road decks
	Railway buckling
	Great Lakes water level reductions; lower flows in major rivers
	Lower air density
	Longer ice-free periods
Cold regions impacts	Loss of permafrost
	Sea level rise and coastal erosion
Greater coastal storm strength with sea level rise	More extreme, or more frequent, coastal flooding
Sector: Energy	
<i>Climate Change</i>	<i>Impact</i>
Average temperature rise	Increased demand for cooling; reduced demand for heating
	More frequent and/or longer heat waves
	Increases in ambient temperature reduce efficiencies and generating capacity of power plants
Changes in precipitation or water availability	Annual or seasonal water scarcity in some regions
Changes in intensity, timing, and location of extreme weather events	Disruption of energy conversion and generation due to extreme events, especially major storms, can effect oil and gas platforms and undersea pipelines

	Disruption of energy transmission and transportation due to extreme events
Sea level rise	Risks to infrastructure in vulnerable coastal areas
Sector: Oceans and Coasts	
<i>Climate Change</i>	<i>Impact</i>
Accelerated sea level rise and lake level changes	Gradual inundation of low-lying land; loss of coastal habitats, especially coastal wetlands; saltwater intrusion into coastal aquifers and rivers; increased shoreline erosion and loss of barrier islands; changes in navigational conditions
Changes in sea ice	Changes in ecosystem structures
	Exacerbate coastal erosion; severe storms reach coast
Increased intensity/frequency of coastal storms	Increased storm surge and flooding; increased wind damage; sudden coastal/shoreline alterations
Ocean acidification	Potential changes in ocean productivity and food web linkages; degradation of corals, shellfish, and other shelled organisms; potential impacts on coastal infrastructure (i.e., construction materials)
Changes in physical and chemical characteristics of marine systems	Changes in salinity; changes in circulation; changes in seawater temperature; changes in salinity and temperature stratification; changes in estuarine structure and processes (e.g., salt wedge migration); changes in ecosystem structure ("invasive", nonnative species), species distributions, population genetics, and life history strategies (including migratory routes for protected and commercially important species); increased frequency and extent of harmful algal blooms and coastal hypoxia events
Changes in precipitation	Increased runoff and nonpoint source pollution or eutrophication; changes in coastal hydrology and related ecosystem impacts; increased coastal flooding

APPENDIX G. Template for Three to Five Priority Actions for FY 2012

Use the following template to identify three to five priority climate change adaptation actions that the agency will implement in FY 2012, including actions to build agency capacity to assess and build resilience to climate change risks, and steps the agency will take to coordinate with other agency adaptation planning and interagency efforts to develop national adaptation plans, where appropriate (discussed in Section III.H).

Action	Scale (National, Regional, Local)	Completion Date	Collaborating Agencies (if applicable)

Sample Table:

Action	Scale (National, Regional or Local)	Completion Date	Other Agencies Collaborating With (if applicable)
<i>Complete high-level analysis of agency vulnerability to climate change.</i>	<i>National</i>	<i>January 2012</i>	<i>NA</i>
<i>Establish intra-agency climate change adaptation planning team to develop a comprehensive FY 2013 adaptation action plan.</i>	<i>National</i>	<i>October 2011</i>	<i>NA</i>
<i>Develop and distribute brochure on how climate change will affect the agency's ability to meet its mission, program, and operational goals and how the steps the agency is taking to adapt will benefit the people it serves.</i>	<i>National</i>	<i>June 2012</i>	<i>NA</i>
<i>Revise Federal Funding Opportunity and grant selection criteria for XXX grant program to include and prioritize projects that improve resilience to climate change. XXX grant program</i>	<i>National</i>	<i>January 2012</i>	<i>NA</i>

<i>will serve as a pilot for expanding to other grant programs within the agency in the future.</i>			
<i>Develop and provide agency-specific interactive training on climate change and how it would impact agency mission and operations for agency leadership and program management staff.</i>	<i>National</i>	<i>April 2012</i>	<i>USGCRP</i>
<i>Conduct literature review and work with sea level rise experts to identify agency locations most vulnerable to current and projected sea level rise; identify three priority areas to conduct more detailed vulnerability assessments of agency coastal infrastructure.</i>	<i>National</i>	<i>February 2012</i>	<i>NOAA, USGCRP, USGS</i>
<i>Conduct pilot climate change vulnerability analysis for location of proposed new facility in Miami, Florida so that adaptive measures can be incorporated into the building's siting and design.</i>	<i>Local—Miami</i>	<i>June 2012</i>	<i>NOAA, EPA</i>

APPENDIX H. Federal Climate Change Adaptation Case Studies

The Department of Homeland Security: Agency-level Adaptation Planning

The Department of Homeland Security's (DHS) 2010 Quadrennial Homeland Security Report¹⁸ identified global climate change as a long-term trend and global challenge facing America's national interests.¹⁹ Recognizing the potential homeland security risks posed by a changing climate, an intra-departmental Climate Change Adaptation Task Force (DHS Task Force) began evaluating how climate change may impact DHS missions and operations risks linked to a changing climate.

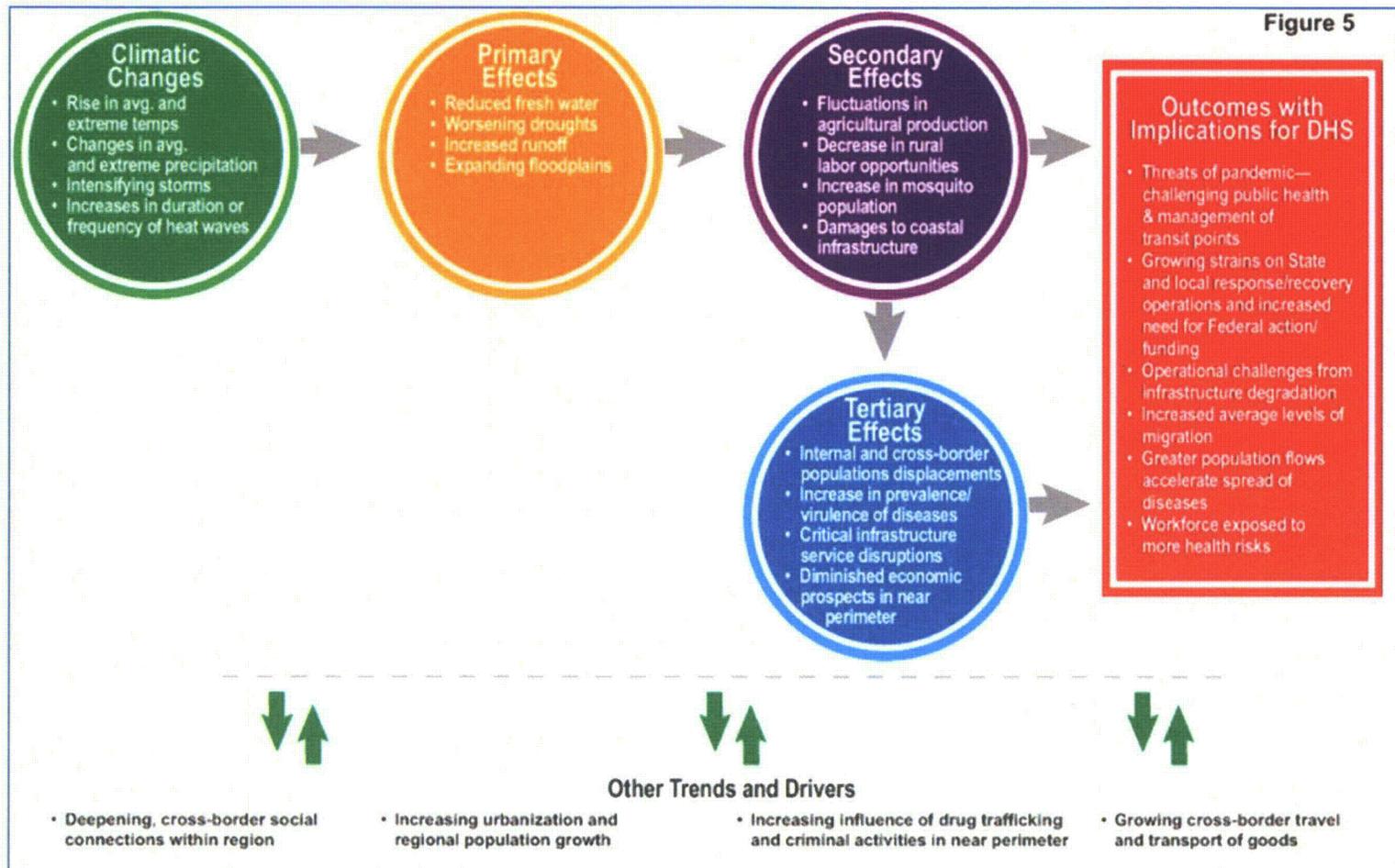
Using the Federal framework for climate change adaptation planning, the DHS Task Force developed case studies of the Southeast and Southwest regions that accounted for potential cross-border impacts linked to the United States' perimeter. Its analysis was based on six months of research, extensive component and mission-specific assessments, and workshops. To assess the potential risks to DHS within these regions, the DHS Task Force focused on issues linked to migration, infrastructure, and health—the areas projected to be most affected by climate change with the most cross-cutting implications for the Department (see Figure on following page).

As a result of this effort, the DHS Task Force completed a report that identified potential areas of action and recommended additional analysis to better understand how the adverse effects of climate change may threaten the broad spectrum of DHS missions, operations, and infrastructure. Following delivery of the report, the DHS Task Force will continue to provide analysis and recommendations to senior leadership concerning climate change adaptation.

¹⁸ www.dhs.gov/xlibrary/assets/qhsr_report.pdf, page 7

¹⁹ www.dhs.gov/xlibrary/assets/mgmt/dhs-strategic-sustainability-performance-plan.pdf, pages 18-19

Figure 5



The Environmental Protection Agency and the Federal Emergency Management Agency:

Community-level Adaptation

Flooding in the state of Iowa caused an estimated \$8-10 billion in damage in 2008. In 2010, the Rebuild Iowa Office partnered with Federal Emergency Management Agency (FEMA) and the Environmental Protection Agency (EPA) to implement the Iowa Climate Change Adaptation and Resilience Pilot. The goal of the project was to identify challenges to, and incentives for, including regional climate change impacts in local planning processes, such as community comprehensive planning and hazard mitigation planning. This effort leveraged existing programs to incorporate the consideration of climate change impacts in planning for and investing in disaster resiliency.

Local, state, and Tribal governments are required to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance. As of November 2010, over 18,300 communities had FEMA approved mitigation plans (including plans that are approvable pending adoption), comprising almost 70 percent of the total national population. Mitigation planning is the process local, state, and Tribal governments use to identify risks and vulnerabilities associated with natural disasters, and develop long-term strategies for protecting people and property in future disasters. The mitigation planning process is an opportunity for communities to increase public awareness, offers a framework for developing feasible and cost-effective mitigation actions, and is the blue print for taking action to reduce risks from natural hazards. These plans incorporate models and data from past disasters in order to plan for future conditions. In addition, local governments in Iowa adopt comprehensive plans that among other things set forth goals, policies, and standards to guide balanced and orderly local development, typically over a ten to twenty year time frame. The plans are designed to promote public health, safety, and prosperity and establish a future vision that attracts economic development, protects and preserves resources, and encourages a strong community identity. Signed into law in 2010, the Iowa Smart Planning Act articulates ten smart planning principles localities must consider in comprehensive planning and public investment decision-making processes, and provides guidance for completing a comprehensive plan. These local planning processes are a prime place to consider climate change impacts.

The Iowa Climate Change Adaptation and Resilience Pilot brought together local climate scientists, emergency managers, planners, elected officials, and Federal agencies to explore ways to include climate change adaptation measures in local hazard mitigation plans. The first step in the process involved identifying relevant climate data and using it to address the needs of local planners. The second step included examining potential barriers to the wider implementation of adaptation planning. The primary challenges that must be surmounted involve downscaling global climate data for local use and integrating

climate scenarios into traditional risk management frameworks. The final report from the pilot will identify specific recommendations addressing both challenges to and incentives for considering the regional effects of climate change in hazard mitigation and other community planning processes.

Department of Transportation: Providing Information to Decision Makers and the Federal Highway Administration Adaptation Pilot

The Department of Transportation (DOT) has undertaken several efforts to better understand and plan for the impacts of climate change on transportation infrastructure. In consultation with Federal science agencies, the Federal Highway Administration (FHWA) developed several reports geared toward transportation agencies on projected climate change effects and impacts. In 2010, the FHWA released *Regional Climate Change Effects: Useful Information for Transportation Agencies*, which provides basic information on projected regional climate change effects (changes in temperature, precipitation, storm activity and sea level rise) in the near-term, by mid-century, and by the end-of-century. The DOT Center for Climate Change and Environmental Forecasting completed Phase 1 of the Gulf Coast Study in March 2008 which analyzed how changes in climate could affect transportation systems in this region over the next 50 to 100 years. A second phase of the Gulf Coast study is focusing on the Mobile, Alabama region and will build on the information developed in Phase 1. The Phase 2 study will identify critical infrastructure, assemble climate data and projections for the region, and assess the vulnerability of the critical infrastructure across modes. The study will also develop transferrable tools and approaches Metropolitan Planning Organizations (MPO) and other transportation agencies and operators can use to determine which transportation systems most need to be protected and to identify and choose suitable adaptation options. In 2008, the Center also completed a study using multiple data sources to identify the potential impacts of global sea level rise on transportation infrastructure along the Atlantic coast from Florida to New York. Finally, an FHWA report, *Integrating Climate Change into the Transportation Planning Process*, summarized the state-of-the-practice in state DOTs and MPOs, including both mitigation and adaptation.

Building on this information for decision-makers, DOT launched a pilot program in 2010 sponsored by the FHWA designed to help transportation decision makers identify infrastructure assets that are most exposed to threats from climate change and the consequences that could result from those threats. The pilot projects involve partnerships with state DOTs, MPOs and other state and local stakeholders. FHWA developed a risk assessment model to aid the DOTs and MPOs in inventorying assets, gathering climate information, and assessing the risk to their assets and the transportation system from climate change. FHWA provided funding to the pilot agencies in the San Francisco Bay Area, Hampton Roads, VA, New

Jersey coast and inland, Washington State, and Oahu, Hawaii to implement the model. The pilots, scheduled to be completed in late 2011, are intended to promote the creation of a more robust and consistent way of addressing climate change vulnerability of transportation agencies.

The Department of Housing and Urban Development: Tackling Climate Change through Funding Opportunities

Through the Department of Housing and Urban Development's (HUD) Sustainable Communities Initiative, the agency is supporting a new generation of community and regional planning aimed at building more climate-resilient communities. The Sustainable Communities Initiative provides funding to metropolitan regions and rural communities to develop integrated, regional development plans to guide state, metropolitan, and local investments in land use, transportation, and housing that use the latest data, analytic, modeling, and mapping tools available. Sustainable Community Challenge Grants also support multi-jurisdictional partnerships in establishing policies, codes, tools, and critical capital investments needed to achieve sustainable and inclusive development.

HUD's Notice of Funding Availability (NOFA) for the regional sustainability planning grants encouraged communities to address climate change adaptation and resilience as part of their regional planning efforts. Eligible activities include:

Conduct comprehensive climate change impacts assessments to guide regional planning and implementation strategies. Assessments may comprehensively evaluate a range of likely climate change impacts or may focus on an impact area of special concern in the region (e.g., sea level rise or reduced water availability). Findings from climate impact assessments should be used as a basis for defining adaptation actions to be implemented in appropriate plans and strategies.

Some of the grant recipients HUD selected for funding were regional planning bodies in areas most vulnerable to flooding and extreme weather conditions: the South Florida Regional Planning Council (Hollywood, Florida), the Houston-Galveston Area Planning Council, and the Gulf Regional Planning Council (Gulfport, Mississippi). The grants will not only help these communities develop strong community and regional plans but will also enable them to articulate a vision for growth, supported by Federal housing, transportation, and other investments, that considers future climate change impacts.

U.S. Army Corps of Engineers: Exploring Federal Climate Change Adaptation at the Project Level

Climate change and variability directly impact water resource management, whether through the management of inland water systems to support flood risk reduction, navigation, ecosystem restoration, hydropower, and water supply, or through coastal shoreline protection and support of deep and shallow draft navigation. As the Nation's oldest and largest water resources management agency, the U.S. Army Corps of Engineers (USACE) is intensely concerned with adaptation to climate change.

Beginning in 2007, USACE embarked on collaboration with other water resources agencies to face the challenges of climate change. The first result was a U.S. Geological Survey (USGS) Circular 1331, "Climate Change and Water Resources Management: A Federal Perspective,"²⁰ a jointly published document by the four major water resources agencies (USACE, Reclamation, USGS, and NOAA). Since then, USACE and its partners have been working to develop consistent methods and procedures to support climate change adaptation. These include updated sea level change guidance,²¹ an expert workshop on nonstationarity²² and another on how to develop best practice guidelines to assess the large and varied portfolio of approaches²³ for producing and using actionable climate science to answer adaptation questions. The latest product is a report, "Addressing Climate Change in Long-Term Water Resources Planning and Management: User Needs for Improving Tools and Information,"²⁴ that identifies the needs of water management agencies for climate change information and tools to support long-term adaptation planning.

USACE is conducting pilot studies of projects at different scales over the full life cycle (planning through operations and maintenance) that focus on specific business management decisions to develop and test alternative adaptation strategies, identify new policies, methods, tools to support adaptation for similar cases, and to test and evaluate the Federal climate change adaptation planning framework. Among these are the Coralville Reservoir, Iowa, which has authorized purposes of flood risk reduction, fish and wildlife, water quality, water supply, and recreation. This pilot leverages a USACE-led UNESCO study, and also complements the Iowa Climate Change Adaptation and Resilience Pilot. A second reservoir pilot involves an interagency (USACE-Reclamation) paired-basin study evaluating the effects of climate change on sedimentation to answer questions about operations and project life. One of the coastal pilots is an ecosystem restoration project impacted by sea level rise encompassing the planning, engineering, and construction phases.

²⁰ See <http://pubs.usgs.gov/circ/1331/> for full report.

²¹ See <http://140.194.76.129/publications/eng-circulars/ec1165-2-211/> for full report.

²² See <http://www.cwi.colostate.edu/NonstationarityWorkshop/index.shtml> to download the workshop.

²³ See <http://www.corpsclimate.us/assessingportfolioworkshop.cfm> for more information.

²⁴ See <http://www.usbr.gov/climate/userneeds/> for full report.

The general lesson learned from these pilots is that time and cost increase as adaptation moves from agency level to project level, and that the flexible framework can be applied at different levels simultaneously. The USACE pilots have provided the following additional lessons learned for agencies considering project level pilots:

- Adaptation requires best available *actionable* science, not simply best available science, and a reasonable idea of the process and how it might change with new knowledge.
- Costs and benefits are dynamic and will change over time just as climate does. We may need to look at regional benefits or quantify changing benefits to capture the dynamics of climate change.
- Consideration of dynamic changes over time can guide adaptive management decisions.
- The pilot leads appreciate the framework's questions-based approach, which leads them to consider adaptation together with other global changes in a holistic manner, resulting in creative solutions that might not be evident in a business-as-usual approach.
- The development and use of consistent national and regional climate scenarios for incorporation in the "Set mandate" and "Understand how climate is changing" steps is critical to support local or project level implementation of the framework.
- The time and cost to study climate impacts and apply them to mission and operations at the project level are orders of magnitude higher than for agency level planning. In one USACE pilot, the cost to undertake the "Understand how climate is changing," and "Apply to Mission and Operations" steps is on the order of two years and several hundred thousand dollars.
- Actual implementation of adaptation options that involve stakeholder collaboration, engineering design, construction, permitting, and environmental impact assessments, can take much longer than the development of agency mandates and a national level understanding of how climate is changing.

The framework is adaptable and general enough to be applied to existing projects at any step of the framework, at any phase in the project lifecycle.

Appendix I. EXAMPLES OF STATE AND LOCAL CLIMATE CHANGE ADAPTATION PLANNING

Maryland

Maryland Governor Martin O'Malley signed an Executive Order in 2007 establishing a Climate Change Commission tasked with creating a Plan of Action to prepare for the impacts of climate change. This Executive Order built upon previous state actions including the implementation of a Sea Level Rise Response Strategy in 2000 and the development of Transition Reports in 2007 to address the consequences of climate change. The Commission included 21 representatives from various state departments, including Agriculture, Budget and Management, Business and Economic Development, Natural Resources, Environment, and Transportation. The Executive Order directed the Commission to report to the Governor and General Assembly on an annual basis to provide a status report and make recommendations to reduce the state's greenhouse gas emissions and vulnerability to climate change impacts.

To help develop the Climate Action Plan, the Governor formed several working groups, including the Adaptation and Response Working Group. The Adaptation and Response Working Group developed a Comprehensive Strategy for Reducing Maryland's Climate Change vulnerability. The Strategy aims to: (1) reduce impacts to existing built environments, as well as to future growth and development; (2) shift to sustainable investments and avoid financial and economic impacts; (3) enhance preparedness to protect human health, safety, and welfare; and (4) restore and protect Maryland's natural resources and resource-based industries. It recommends short- and long-term adaptation measures to achieve these goals.

Maryland's state agencies are working together, along with their partners, to begin implementing the Strategy's short- and long-term actions. For more information see:

<http://www.mdclimatechange.us/index.cfm>.

Oregon

Oregon adopted a Climate Change Adaptation Framework in 2010. The Framework was developed, at the request of Governor Ted Kulongoski, by a workgroup including members of state agencies, universities, and research institutions. The Framework responds to projected changes in temperature, precipitation, water supply, and the loss of ecosystem services due to climate change. It also asserts that adapting to changing climatic conditions is essential to maintaining and improving Oregon's economic resilience. In addition, the Framework acknowledges that state agencies dedicated to protecting public health and safety also have a responsibility to the citizenry to minimize the negative consequences of climate change. The Framework proposes low-cost priority actions yet recognizes that early investments

in adaptation can yield long-term benefits. The short-term priority actions recommended under the Framework include restoring wetlands and riparian zones and improving the capacity of the public health system to respond to heat events. In order to implement the Framework, the workgroup recommended identifying needed research, improving the capacity of state agencies to perform environmental monitoring, mainstreaming adaptation into agency operations, and integrating economic information into adaptation planning. For more information see:

<http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/index.shtml>.

King County, WA

Under the leadership of former County Executive Ron Sims and the County Council, King County formed an interdepartmental climate change adaptation team in 2006 staffed by representatives from the Departments of Natural Resources and Parks, Transportation, Development and Environmental Services, Public Health, and Executive Services. The 2007 King County Climate Plan committed the county to reduce greenhouse gas emissions and adapt to projected climate change impacts. The report projected warmer temperatures, sea level rise, increased flooding, and reduced stream flow due to reductions in snowpack. In order to address these challenges, the Plan calls for greater regional coordination, the study and monitoring of climate impacts, engagement with public and private stakeholders, and the incorporation of climate change impacts into departmental plans. Specifically, the plan suggests modifications to infrastructure including the use of permeable pavement, increased use of reclaimed water, replacing bridges, and strengthening seawalls.

In 2010, King County released its third annual Climate Report to review implementation of the 2007 Climate Plan. To prepare for more frequent flooding, the King County Flood Control District repaired levees and acquired at-risk property on floodplains. In addition, the county began choosing pavement materials more resilient to heat and increasing the size of stormwater facilities. It also began efforts to plan for the projected public health impacts of climate change, including more heat waves and new infectious diseases. The report outlines plans for a grant-funded program to provide incentives to landowners to maximize carbon sequestration and maintain resilient forest ecosystems. For more information see: <http://www.kingcounty.gov/environment/climate.aspx>.

Miami-Dade County, FL

Miami-Dade County created a Climate Change Advisory Task Force in 2006 and became a pilot member of ICLEI's Climate Resilient Communities adaptation program in 2007. The Task Force includes members of universities, non-profit organizations, private firms, regional and state planning bodies, and Federal agencies. The Task Force recommended that the Board of County Commissioners strengthen

building standards for roads, buildings, ports, airports, and bridges in response to sea level rise, saltwater intrusion, and increases in severe weather. The county's vulnerability to climate change was highlighted by an Organisation for Economic Co-operation and Development study identifying Miami-Dade County as the world's most vulnerable municipality, with \$3.5 trillion in assets threatened by coastal flooding. In 2009, the county partnered with three other counties to form the Southeast Regional Climate Change Compact to foster collaboration on climate change mitigation and adaptation efforts. In addition, the county worked with NOAA in 2010 to train department heads and operational staff on how to incorporate climate change adaptation into their work. The county has pursued specific adaptation strategies including strengthening building codes and dredging canals to improve drainage in response to the increasing severity of weather events. For more information see:

http://www.miamidade.gov/derm/climate_change.asp.

New York City, NY

In 2008, Mayor Michael Bloomberg articulated two urgent challenges facing New York City. The first was to slow climate change by shrinking the city's carbon footprint. The second was to adapt to the environmental changes already taking place due to climate change. In order to address this second challenge, the Mayor launched a Climate Change Adaptation Task Force to develop adaptation strategies to minimize climate change impacts on the city. The Task Force, supported by a grant from the Rockefeller Foundation's Climate Change Resilience Program, included representatives of city and state agencies and private firms. A panel of academic, legal, engineering, and insurance experts also advised the Task Force. The Task Force built upon the work of the city's Department of Environmental Protection, which released an Assessment and Action Plan in 2008 detailing adaptation strategies related to the city's water supply, drainage, and wastewater systems. A 2009 city-initiated study, Climate Risk Information, that analyzed potential climate change scenarios and their implications for the city also informed the Task Force's work. The Task Force inventoried at-risk infrastructure, developed coordinated adaptation plans, and drafted design guidelines for new infrastructure that accounts for anticipated climate change impacts. As a result of the Task Force's work, the city is pursuing a number of actions including updating the city's building codes to address the impacts of climate change, ensuring that floodplain maps reflect the most current information, and creating a strategic planning process to address climate change impacts. For more information see:

<http://www.nyc.gov/html/planyc2030/html/plan/climate.shtml>.

Chicago, IL

Chicago Mayor Richard M. Daley convened the Chicago Climate Task Force in 2007 to reduce the city's greenhouse gas emissions. In 2008, the Task Force, which included representatives from state and local

government as well as the non-profit and private sectors, released the Chicago Climate Action Plan. In addition to identifying actions to reduce greenhouse gas emissions, the plan outlined nine steps the city could take to adapt to the expected impacts of climate change. The plan anticipated increased temperatures and increased frequency and intensity of precipitation. In response, the plan suggested strategies to manage heat, protect air quality, and handle storm water.

In 2010, the city released a Progress Report detailing steps taken as a result of the Climate Action Plan. The Progress Report demonstrated a number of adaptation achievements. To reduce runoff, more than 32,000 square feet of impervious surfaces have been converted into pervious surfaces. In order to improve air quality and reduce the heat island effect, more than four million square feet of green roofs have been planned or completed. The Chicago Trees Initiative has also worked to expand the tree canopy. Part of this effort included quantifying the benefits of the urban forest. They found that Chicago's trees sequester 25,200 tons of carbon per year at a value of \$14.8 million per year. In addition, the Chicago Plan Commission adopted a comprehensive plan that includes 21 action items to promote green infrastructure. Recently, the Chicago Department of Environment launched an Ecosystem Adaptation Advisory Group to examine the effects of climate change on ecosystems and the Department of Health has begun to explore ways to monitor the risks climate change poses to vulnerable human populations. For more information see: <http://www.chicagoclimateaction.org/>.

Keene, NH

Keene, as a pilot participant in ICLEI's Climate Resilient Communities program, began the process of preparing for climate change impacts in 2007 and integrated climate adaptation into its Community Vision and Comprehensive Plan. The city's Climate Resilient Communities Committee included city officials, local stakeholders, and professors from nearby universities, and was supported by representatives from ICLEI and NOAA's Regional Integrated Sciences and Assessments staff. The Committee's 2007 report, *Adapting to Climate Change*, acknowledges that climate change has and will result in more frequent and severe flooding, changes in snowfall patterns, the infestation of non-native plant and animal species, higher temperatures, and degraded air quality. In response, the city created a Climate Resilient Action Plan to guide its response to climate change. The city identified vulnerabilities, prioritized its goals, and planned for implementation. Among the actions the city pursued were encouraging steeply pitched roofs to shed snow, identifying a 200-year floodplain and preventing development in these areas, adopting a green building code, reconstructing roadways to handle changes in temperature and precipitation, protecting ecosystems, and addressing public health challenges. In 2010, the city received ICLEI's Sustainability Leadership Award in recognition of its efforts. For more information see: <http://www.ci.keene.nh.us/sustainability/climate-change>.

APPENDIX J. Resources for Climate Change Adaptation Planning

Resources for climate change adaptation planning are provided below. Additional resources are compiled from the Federal tools and resources for climate change adaptation identified in the Pew Center on Global Climate Change's November 2010 report, *Climate Change Adaptation: What Federal Agencies are Doing*.²⁵ Federal agencies should find these additional resources helpful as they move forward with understanding climate change impacts and opportunities and as they develop and implement adaptation planning.

Recommended First Start

U.S. Global Change Research Program. 2009. *Global Climate Change Impacts in the United States*.
www.globalchange.gov/usimpacts

----- 2009. *Synthesis and Assessment Products*.
<http://www.globalchange.gov/publications/reports/scientific-assessments/saps>

National Academies of Science. 2010. *Advancing the Science of Climate Change, America's Climate Choices*. National Research Council
<http://americasclimatechoices.org/panelscience.shtml>

National Academies of Sciences. 2010. *Adapting to the Impacts of Climate Change*. National Research Council. <http://americasclimatechoices.org/paneladaptation.shtml>

For further information from the Federal science agencies:

Centers for Disease Control. 2010. *National Environmental Public Health Tracking Network*.
<http://ephtracking.cdc.gov/showHome.action>

National Biological Information Infrastructure. 2011. *GAP Analysis Program Land Cover Viewer*.
<http://www.gap.uidaho.edu/landcoverviewer.html>

National Integrated Drought Information System. 2011. *U.S. Drought Portal*. www.drought.gov

U.S. Department of Agriculture. 2011. *NCSU/APHIS Plant Pest Forecast System*.
<http://www.nappfast.org>

Natural Resources Conservation Service. 2011. *Water and Climate Information*.
<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

----- 2010. *National Resources Inventory*. <http://www.nrcs.usda.gov/technical/NRI/>

²⁵ See <http://www.pewclimate.org/publications/report/climate-change-adaptation-what-federal-agencies-are-doing> for full report.

----- 2009. *Web Soil Survey and National Cooperative Soil Survey for the United States*.
<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

U.S. Department of Commerce

National Oceanic and Atmospheric Administration. 2011. *NOAA Climate Service*.
www.climate.gov

----- 2011. *Coastal Services Center*. <http://www.csc.noaa.gov/>

----- 2010. *NOAA Regional Climate Centers*.
<http://www.ncdc.noaa.gov/oa/climate/regionalclimatecenters.html>

----- 2010. *Climate Prediction Center*. <http://www.cpc.noaa.gov/>

----- 2010. *Climate Program Office*. http://www.climate.noaa.gov/about_climate/index.jsp

U.S. Department of the Interior. 2011. *Climate Science Centers*.

<http://www.doi.gov/whatwedo/climate/strategy/CSC-Map.cfm>

----- 2011. *Landscape Conservation Cooperatives*.

<http://www.doi.gov/whatwedo/climate/strategy/LCC-Map.cfm>

----- National Park Service. 2010. *The Inventory and Monitoring Program*.

<http://science.nature.nps.gov/im/index.cfm>

From Federal Mission Agencies:

U.S. Department of Transportation; Federal Highway Administration. 2010. *Regional Climate Change Effects: Useful Information for Transportation Agencies*.

http://www.fhwa.dot.gov/hep/climate/climate_effects/

U.S. Department of Transportation. 2011. *Transportation and Climate Change Clearinghouse*.

<http://climate.dot.gov/>

U.S. Environmental Protection Agency. 2011. *Water Resource Adaptation Program*.

<http://www.epa.gov/nrmrl/wswrd/wqm/wrap/index.html>

----- 2010. *Climate Change*. <http://www.epa.gov/climatechange/>

----- 2010. *Climate Change Indicators in the United States*.

http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf

----- 2010. *Climate Ready Estuaries*. <http://www.epa.gov/cre/>

----- 2010. *Global Change Impacts & Adaptation*. <http://www.epa.gov/ncea/global/index.htm>

U.S. Fish and Wildlife Service. 2011. *Sea Level Affecting Marshes Model*. <http://www.fws.gov/slamm/>

- U.S. Forest Service. 2011. *Global Climate Change Research: Forest Service Research and Development*. <http://www.fs.fed.us/research/climate/>
- , 2011. *Climate Change Resource Center*. <http://www.fs.fed.us/ccrc/>
- , 2011. *Climate Change Tree Atlas*. http://nrs.fs.fed.us/atlas/tree/tree_atlas.html
- , 2011. *Climate Change Bird Atlas*. <http://nrs.fs.fed.us/atlas/bird/index.html>
- , 2011. *Eastern Forest Environmental Threat Assessment Center*. <http://www.forestthreats.org/>
- , 2011. *MAPSS Global Vegetation Model*. <http://www.fs.fed.us/pnw/mdr/mapss/>
- , 2011. *The Northern Institute of Applied Climate Science*. <http://www.nrs.fs.fed.us/niacs/>
- , 2011. *Western Wildland Environmental Threat Assessment Center*. <http://www.fs.fed.us/wwetac/wwetac.html>

From the Intergovernmental Panel on Climate Change:

Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. www.ipcc.ch

Planning Resources:

- Federal Emergency Management Agency. 2010. *Coastal Construction Manual*. <http://www.fema.gov/rebuild/mat/fema55.shtm>
- National Academy of Sciences. 2010. *Adapting to the Impacts of Climate Change*. National Research Council. www.nap.edu
- National Oceanic and Atmospheric Administration. 2010. *Legislative Atlas*. <http://www.csc.noaa.gov/digitalcoast/tools/legatlas/>
- , 2010. *Adapting to Climate Change: A Planning Guide for State Coastal Managers*. <http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf>
- National Park Service. 2010. *Adaptation and Scenario Planning*. <http://www.nature.nps.gov/climatechange/adaptationplanning.cfm>
- Pew Center on Global Climate Change. 2010. *Climate Change Adaptation: What Federal Agencies are Doing*. <http://www.pewclimate.org/docUploads/Federal-Government-Leadership-Adaptation-Nov-2010.pdf>
- U.S. Agency for International Development. 2009. *Adapting to Coastal Climate Change: A Guidebook for Development Planners*. http://www.usaid.gov/our_work/cross-cutting_programs/water/docs/coastal_adaptation/adapting_to_coastal_climate_change.pdf

- 2007. *Adapting to Climate Variability and Change: A Guidance Manual for Development Planning*. http://www.usaid.gov/our_work/environment/climate/docs/reports/cc_vamannual.pdf
- U.S. Army Corps of Engineers. 2009. *Water Resource Policies and Authorities: Incorporating Sea-Level Change Considerations in Civil Works Programs*. USACE Circular 1165-2-211. <http://140.194.76.129/publications/eng-circulars/ec1165-2-211/entire.pdf>
- U.S. Environmental Protection Agency. 2006. *Excessive Heat Events Guidebook*. http://www.epa.gov/heatisland/about/pdf/EHEguide_final.pdf
- U.S. Department of the Interior. 2011. *Climate Change – Adaptation and Decision Support Tools*. <http://www.doi.gov/whatwedo/climate/adaptation.cfm>
- 2009. *Adaptive Management Technical Guide*. <http://www.doi.gov/initiatives/AdaptiveManagement/documents.html>
- U.S. Fish and Wildlife Service. 2011. *National Fish and Wildlife Climate Adaptation Strategy*. <http://www.fws.gov/nfwcas.html>
- U.S. Forest Service. 2011. *Template for Assessing Climate Change Impacts and Management Options*. <http://www.forestthreats.org/tools/taccimo>
- 2010. *Roadmap for Responding to Climate Change*. <http://www.fs.fed.us/climatechange/pdf/roadmap.pdf>
- 2009. *Adaptation Planning: What US States and Localities are Doing*. <http://www.pewclimate.org/docUploads/state-adapation-planning-august-2009.pdf>
- U.S. Geological Survey. 2009. *Climate Change and Water Resources Management: A Federal Perspective*. USGS Circular 1331. <http://pubs.usgs.gov/circ/1331>
- 2009. *National Assessment of Coastal Vulnerability to Sea-Level Rise*. <http://woodshole.er.usgs.gov/project-pages/cvi/>

Training and Education

- Centers for Disease Control. 2010. *Climate Change and Health Webinar Series*. <http://www.cdc.gov/climatechange/workforce.htm>
- Natural Resources Conservation Service. 2010. *Online Air Quality and Energy Courses*. http://www.extension.org/pages/NRCS_Online_Air_Quality_and_Energy_Courses
- U.S. Fish and Wildlife Service. 2010. *Climate Change Learning Center*. http://training.fws.gov/CSP/Resources/CSP_Climate_Change_Series/index.htm
- U.S. Forest Service. 2011. *Adapting to Climate Change – A Short Course for Land Managers*. <http://www.fs.fed.us/ccrc/hjar/>